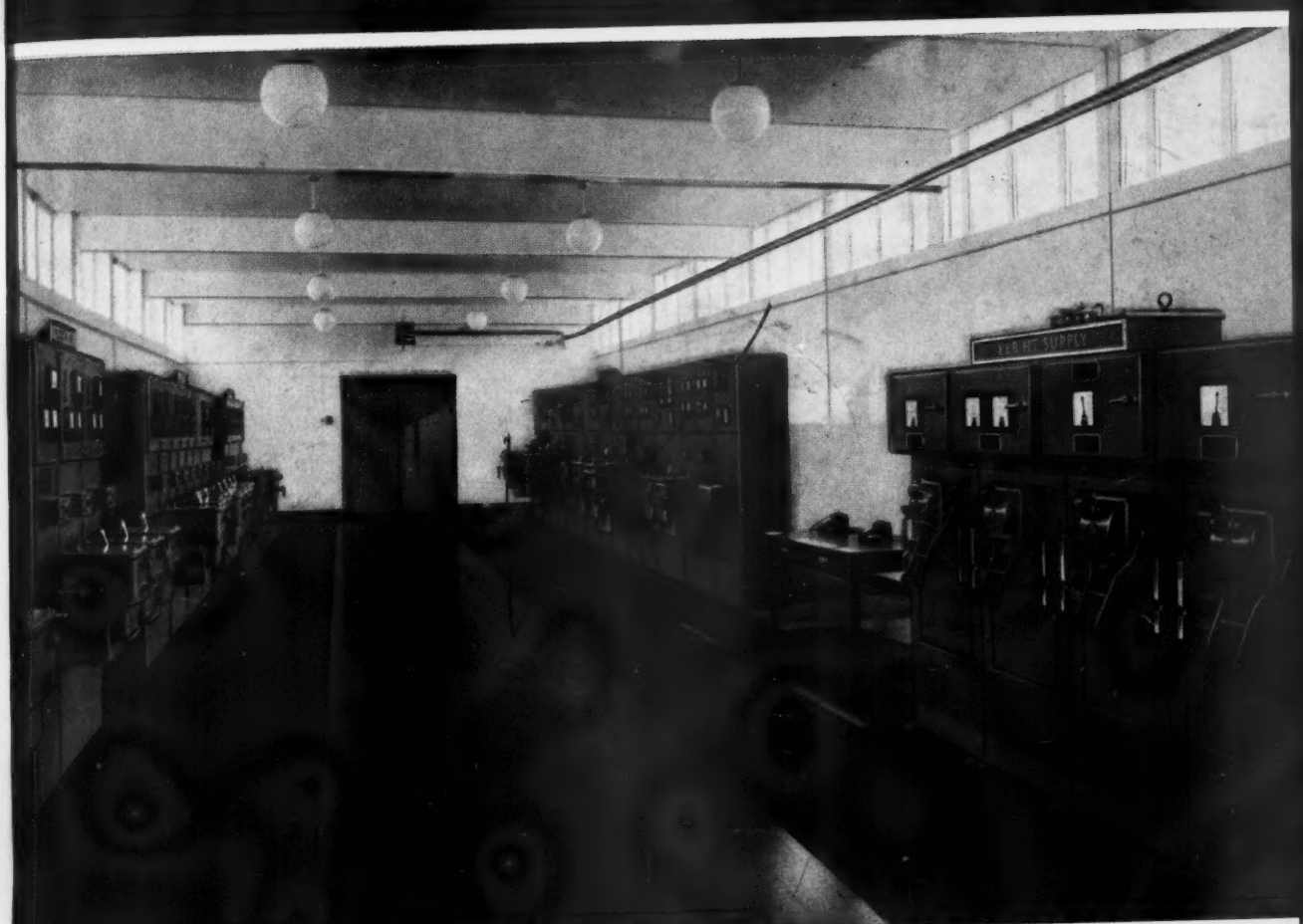
ELECTRICAL REVIEW



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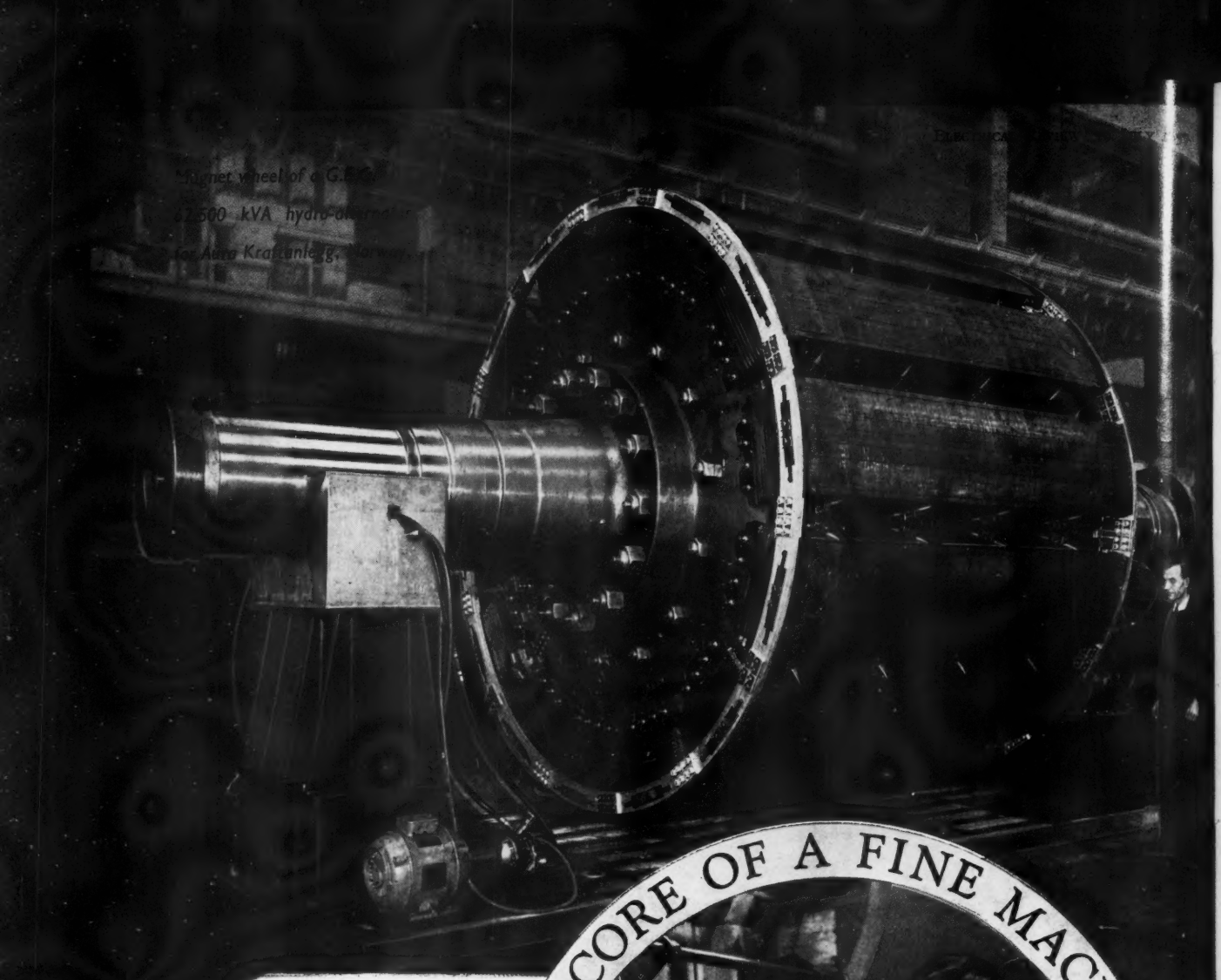

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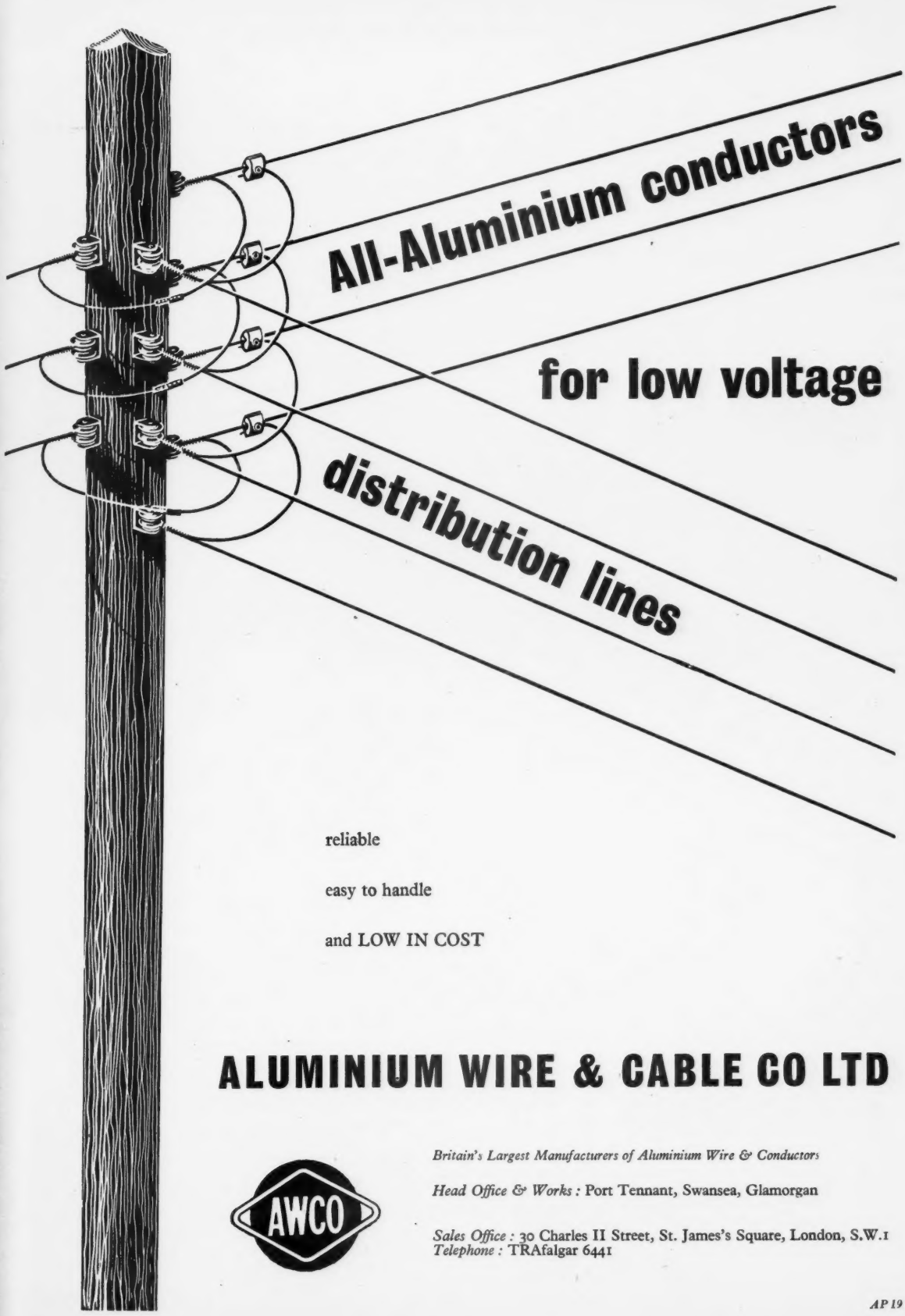

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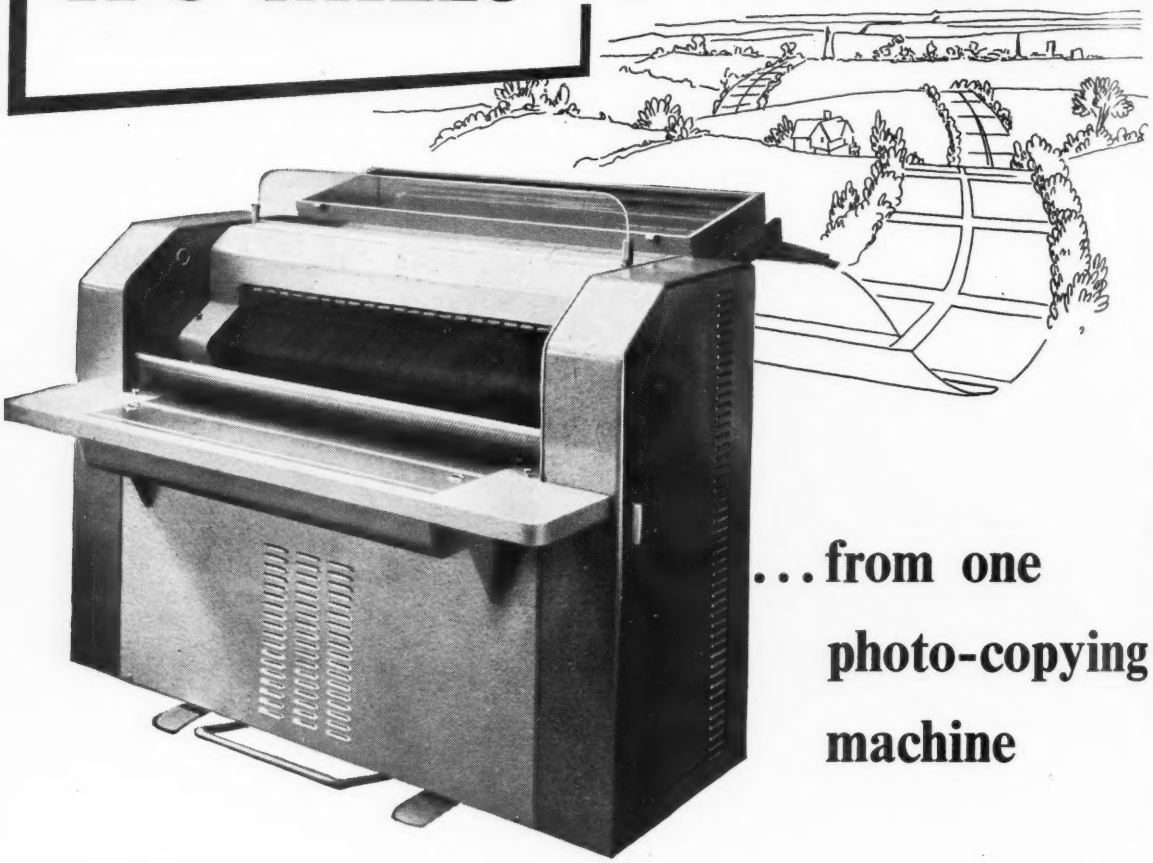

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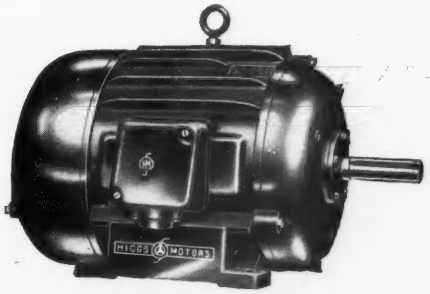

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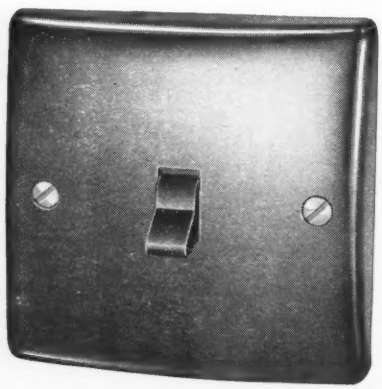
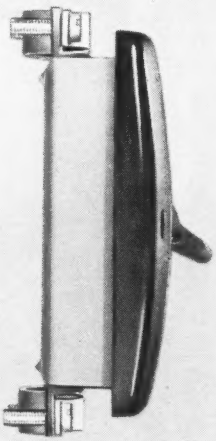
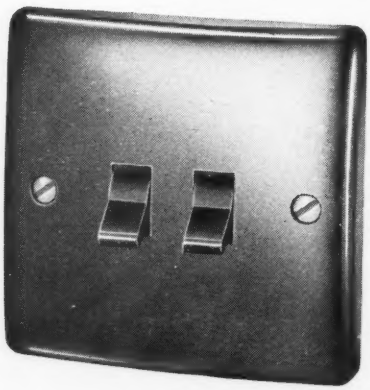


Standard 3¼" square AC Plate Switch. One-gang pattern.



Side view of 'Tay' pattern switch showing shallow construction.



Standard 3¼" square AC Plate Switch. Two-gang pattern.

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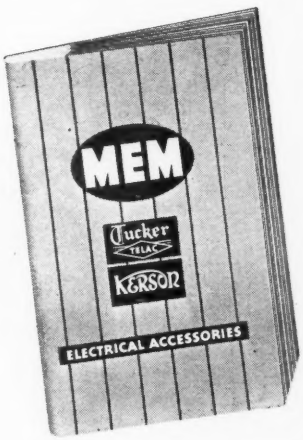

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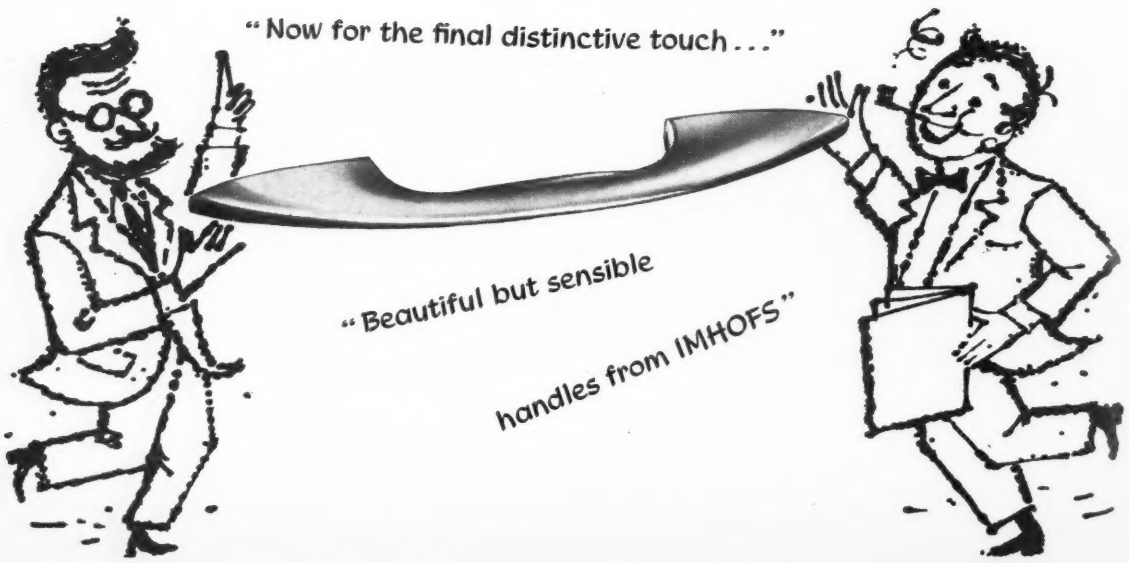

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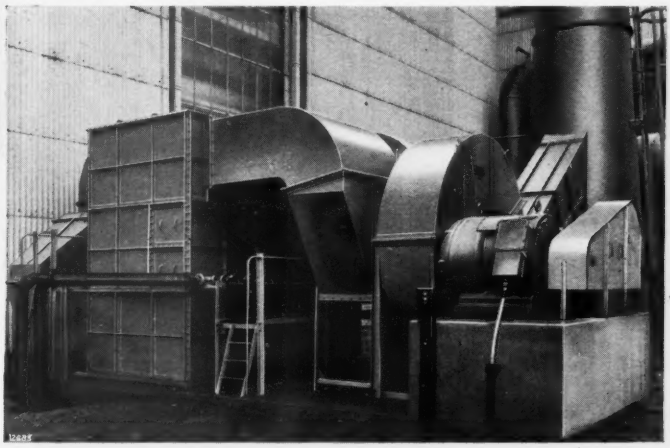

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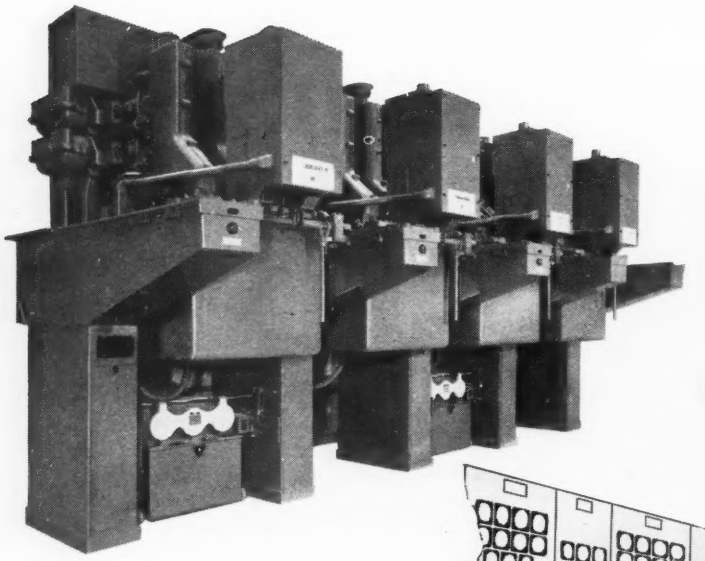
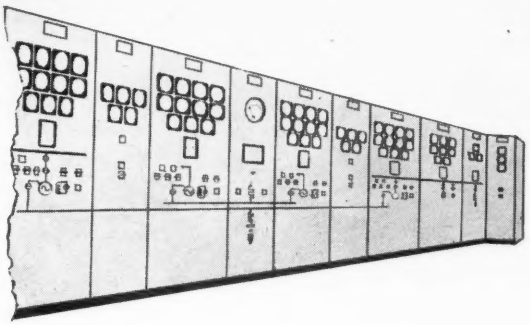


generator switchgear at Calder Hall



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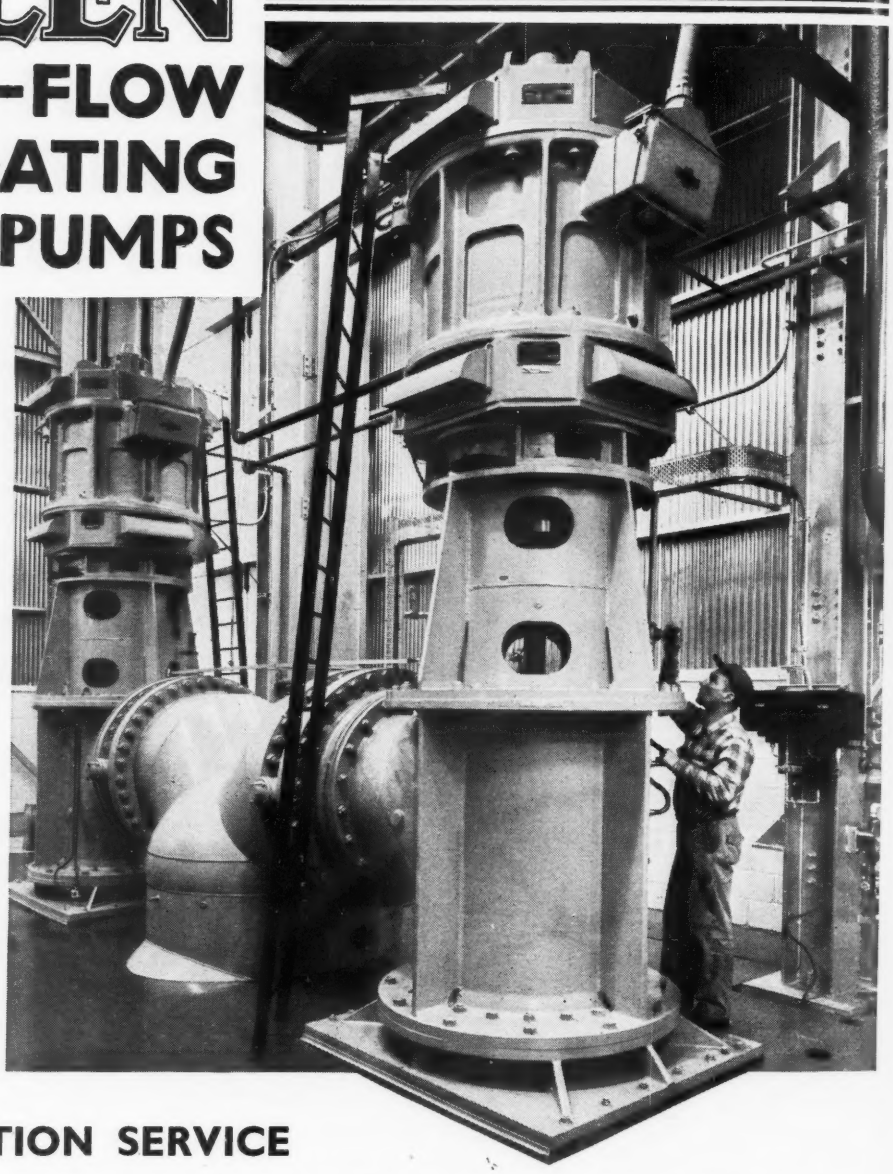

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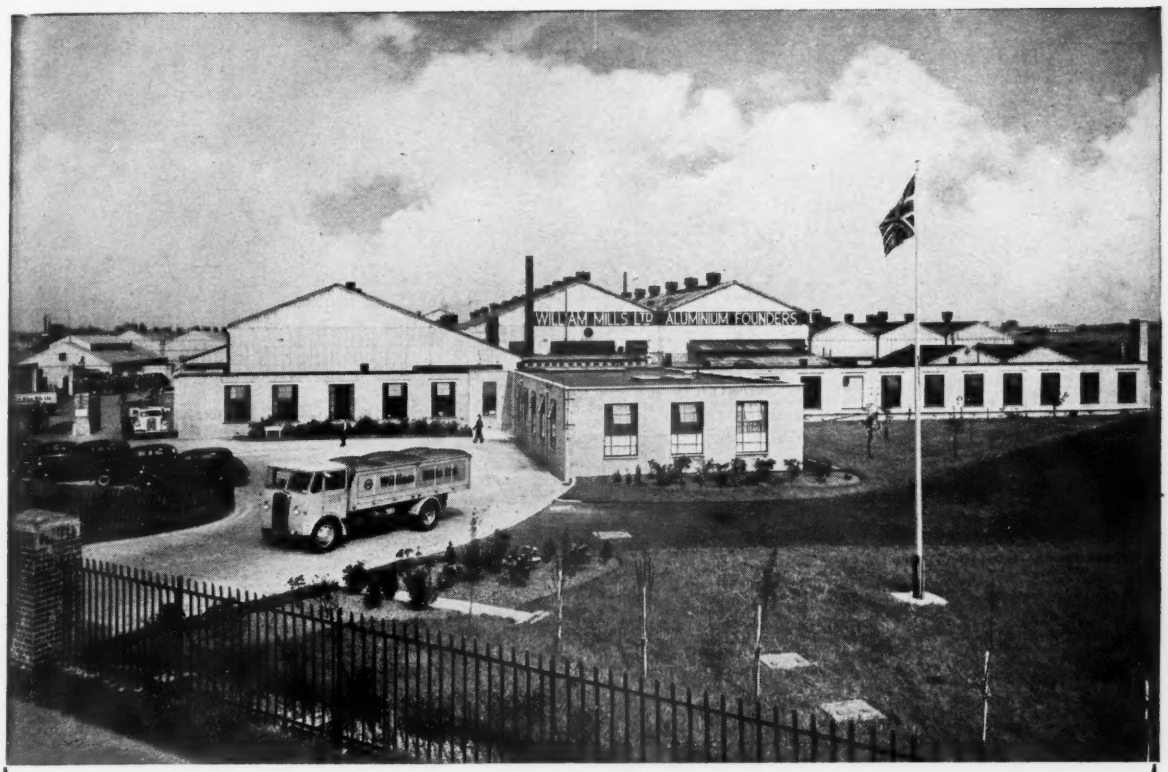

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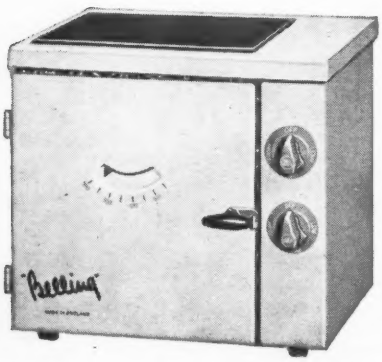

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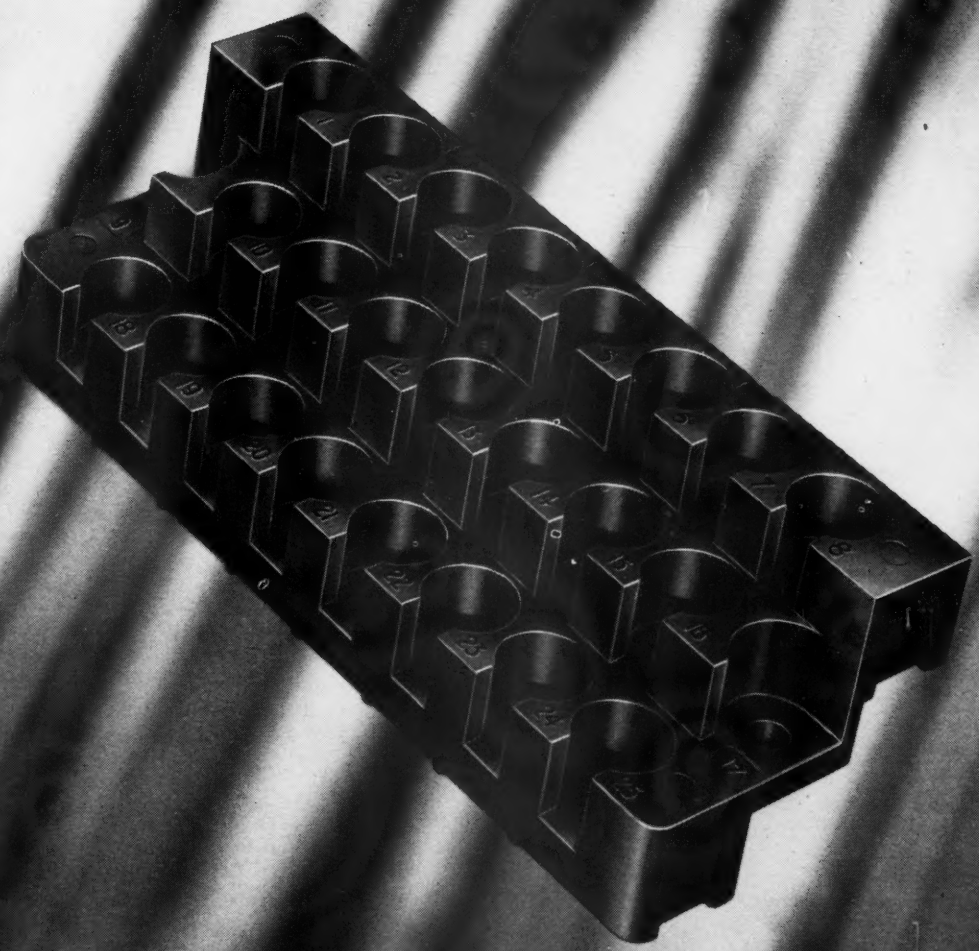

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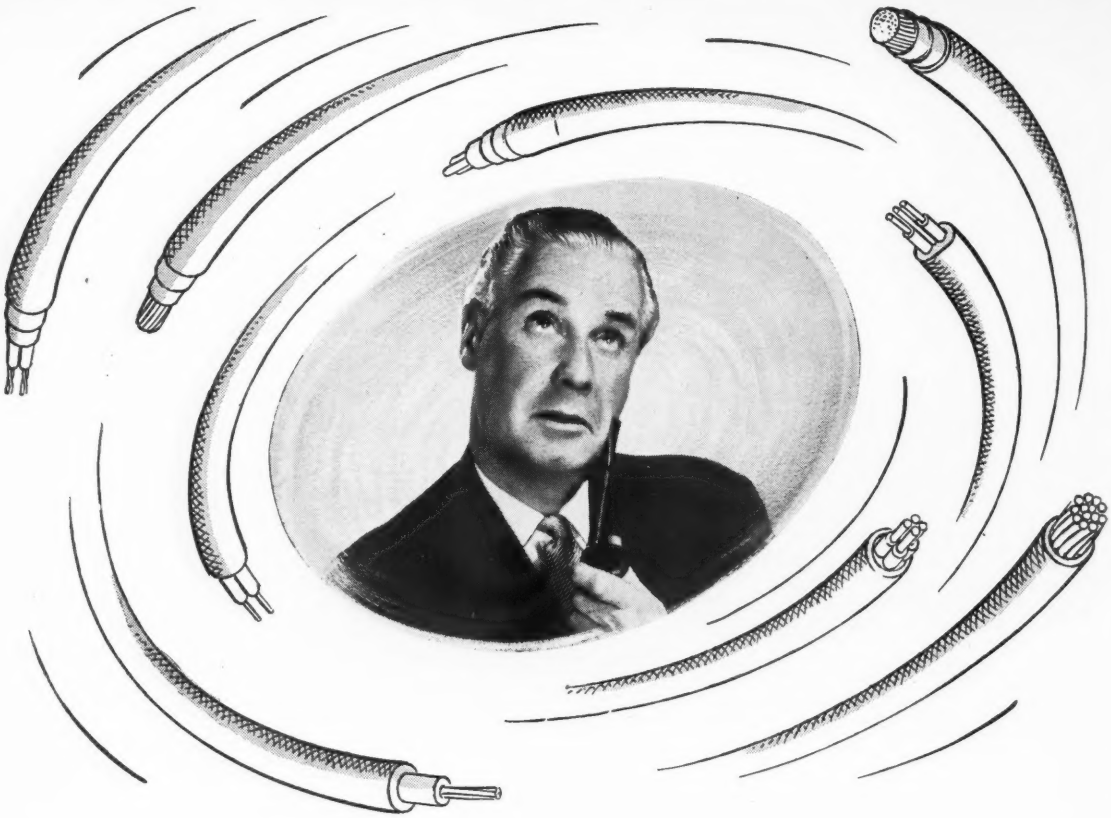

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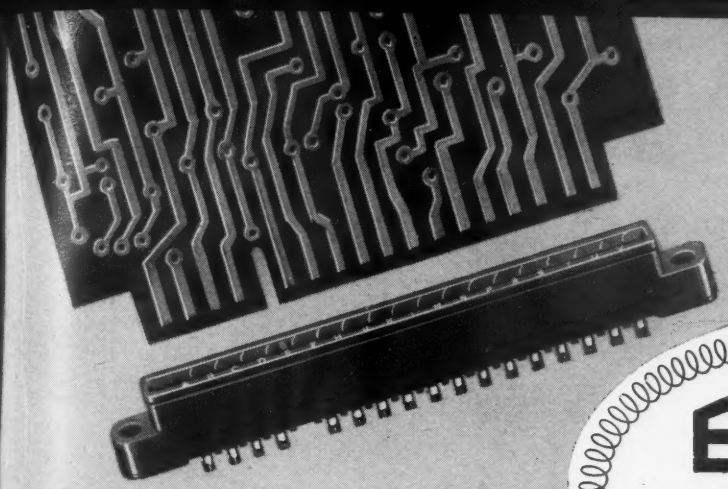

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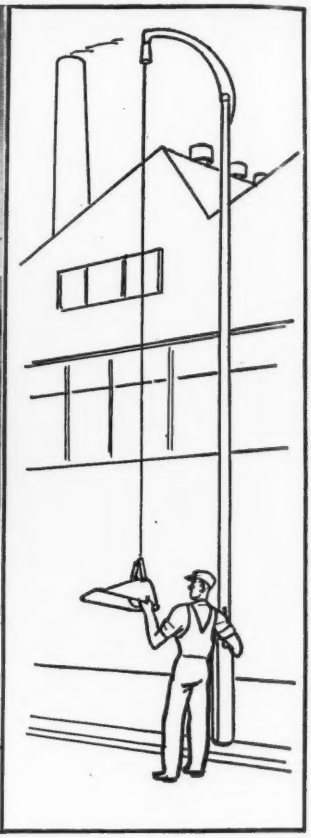

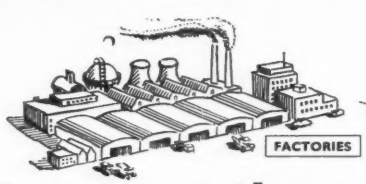
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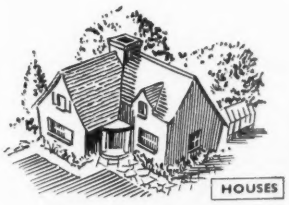
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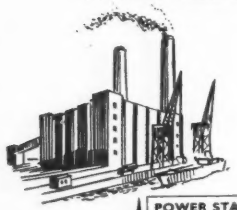
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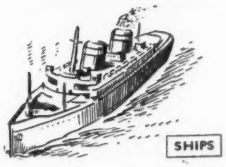
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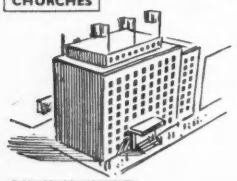
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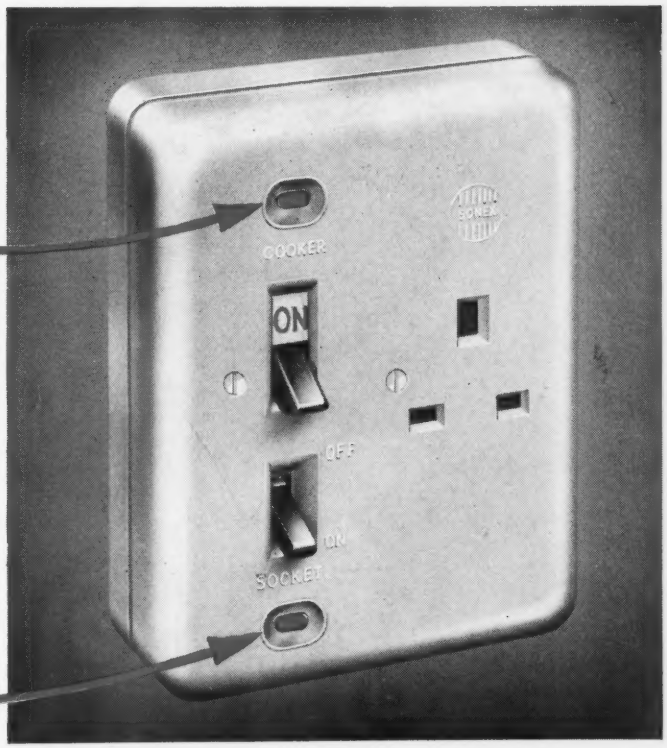

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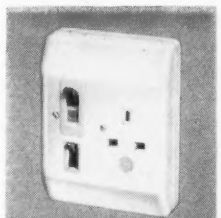
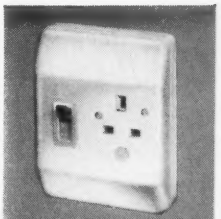
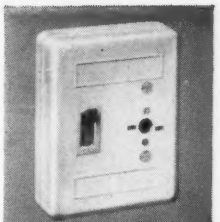


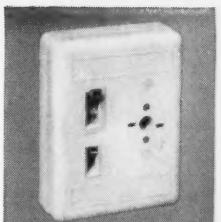
Sonex Cooker Unit 750
As above, but without Pilot Lights: **25/-** (excluding Plug).



Sonex Cooker Unit 740
60 amp. Switch controls Cooker. B.S. 1363 socket, unswitched. **25/-** (excluding Plug).



Wylex Cooker Unit W.S.U.
30 amp. Switch for Cooker. Wylex 15 amp. ring main socket controlled by 15 amp. D.P. Switch. **25/-** (excluding Plug).



Wylex Cooker Unit W.R.C.U.
60 amp. Switch for Cooker. Wylex 15 amp. socket outlet, unswitched. **25/-** (excluding Plug).

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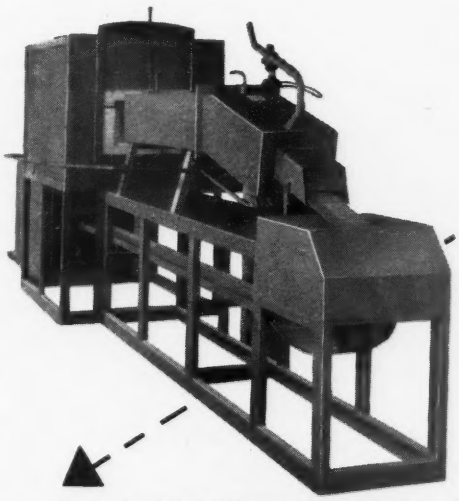

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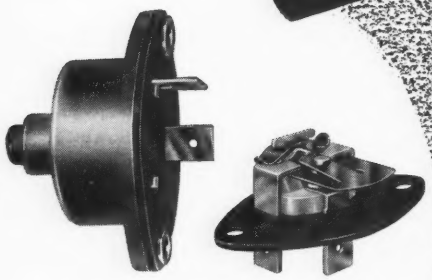

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★ Mycalex insulation.
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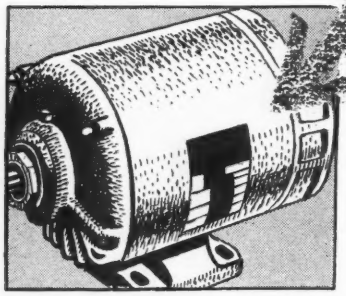
★ Interchangeable with others.



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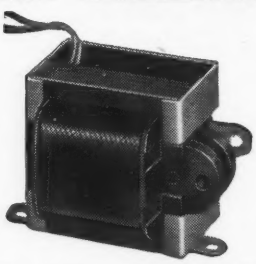

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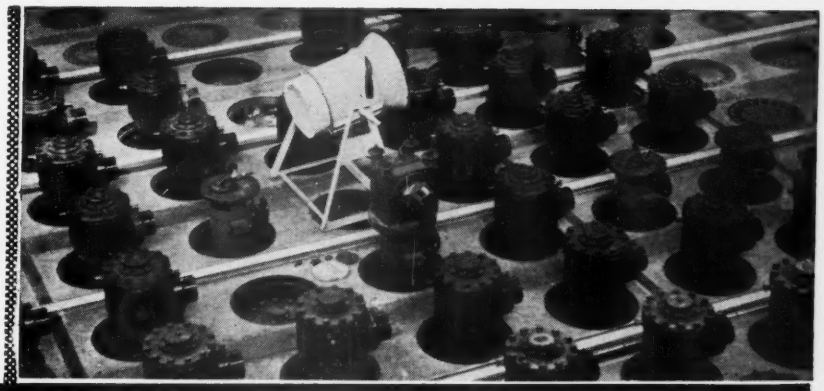
Silicone insulated motors drive the vital control rod-actuating mechanism of the reactors at Calder Hall, Britain's first atomic power station. There are sixty silicone insulated Metropolitan-Vickers motors for each reactor charging face, as illustrated.



MS

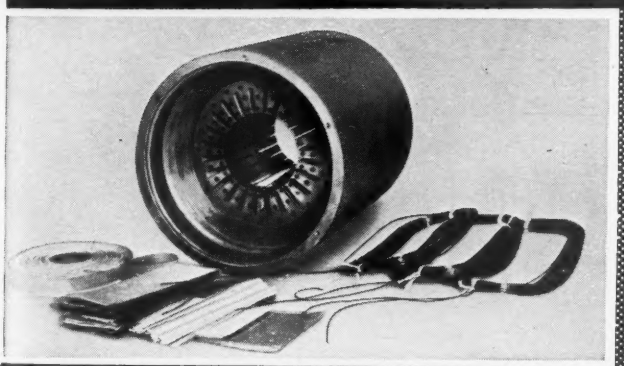
SILICONE INSULATED MOTORS for CALDER HALL

Silicone resins and elastomers, because of their extreme resistance to heat, have made possible a new class of electrical insulation – (Class H – BS 2757: 1956) that has many times the life of conventional insulation under comparable operating conditions. The extraordinary stability of insulating materials based on MS silicones enables radical improvements to be made in the performance of electrical equipment such as motors, transformers and cables.

SILICONE INSULATED ELECTRICAL APPARATUS IS MORE RELIABLE–

Electrical plant must be dependable. Breakdowns can often be very expensive in terms of lost production time. MS silicones strengthen the weak link in all forms of electrical equipment—its insulation. With silicone insulated equipment the risk of breakdown through insulation failure is very greatly reduced.

–AND SAFER. Silicone insulated dry-type transformers offer a safer alternative to oil-filled units.



One of the motors is shown before winding. The following silicone insulation components are employed:

CONDUCTOR WIRES – *Silicone-enamelled wire.*
SLOT LINERS – *Silicone-bonded mica backed with glasscloth.*
SLOT WEDGES – *Silicone-bonded glasscloth laminate.*
TAPE – *Silicone varnish-impregnated glasscloth.*
IMPREGNATION – *MS silicone impregnating varnish.*

Photograph by courtesy of Metropolitan-Vickers Electrical Co. Ltd.

OUR ELECTRICAL ENGINEERS CAN HELP YOU

Our electrical engineers and Technical Service Department are ready to help you in the choice of silicone insulation and its application.

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The all-insulated units are complete with their own self-contained mounting blocks and are ready to fix straight to the wall. There is an incombustible compartment to house the cables.

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The terminals are placed for easy wiring and are generously sized. Good earthing facilities are provided.

EASY TO LOOK AT!

The styling of these new units is modern and attractive. They are extremely compact and unobtrusive.

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A range of flush pattern switches will be announced in the very near future.

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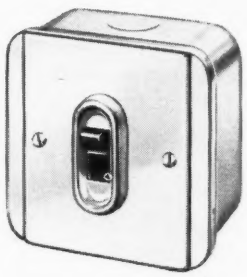
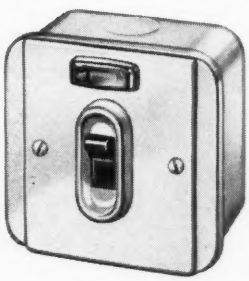


List No. 5212

List No. 5222



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B-W Tropical Chambers
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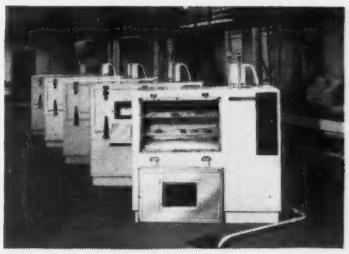
A complete range of standard types and sizes for testing components or complete assemblies to all specifications.

A typical "B-W" Tropical Chamber for testing large assemblies is seen on left.



Group of small "B-W" Testing Cabinets for components and sub-assemblies is illustrated above (photo by courtesy of Nash & Thompson Ltd., Chessington, Surrey).

OTHER "B-W" PRODUCTS INCLUDE: FURNACES, OVENS, IMPREGNATING PLANTS, WAX KETTLES, ETC.

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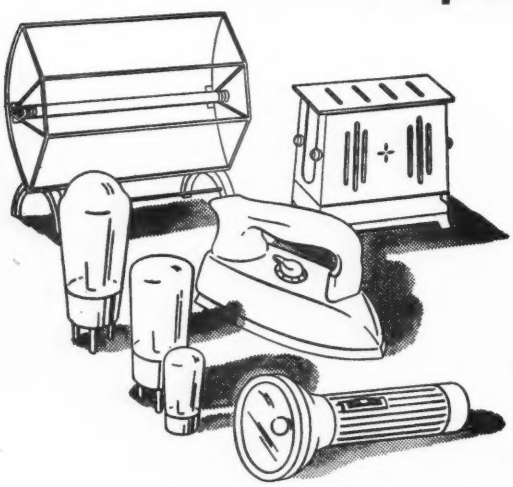

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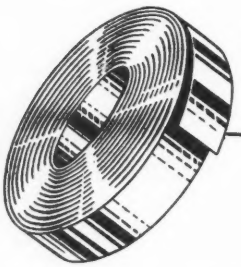

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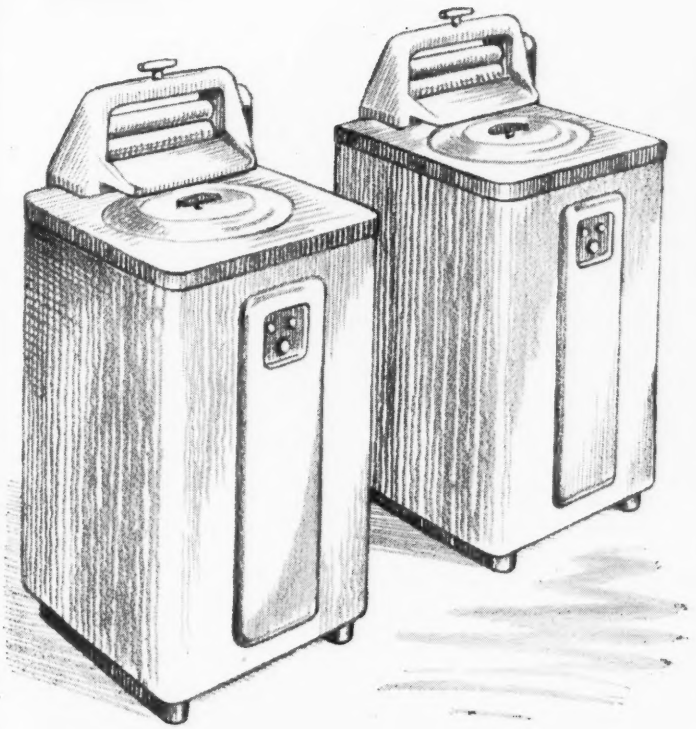

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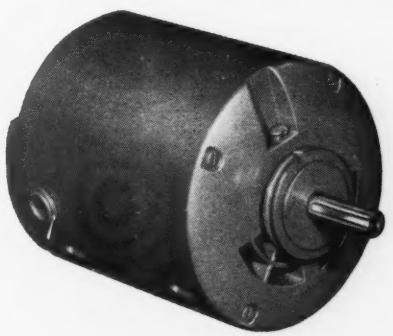

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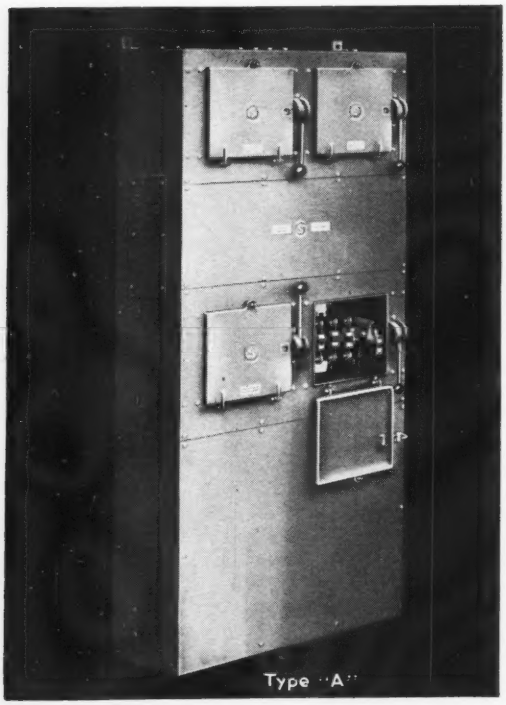

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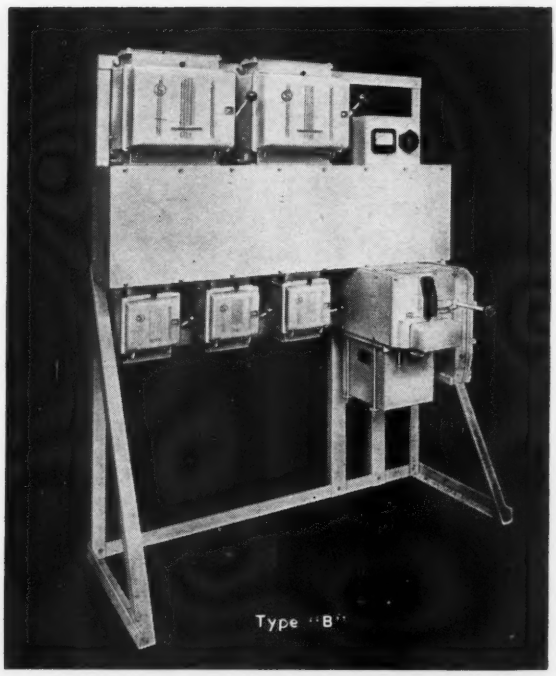

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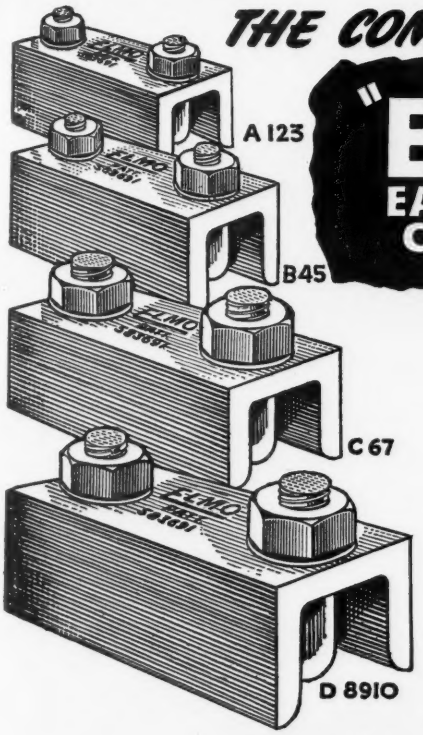

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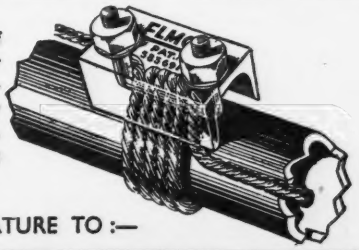

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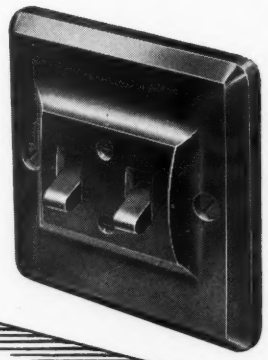

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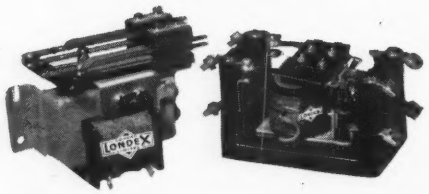

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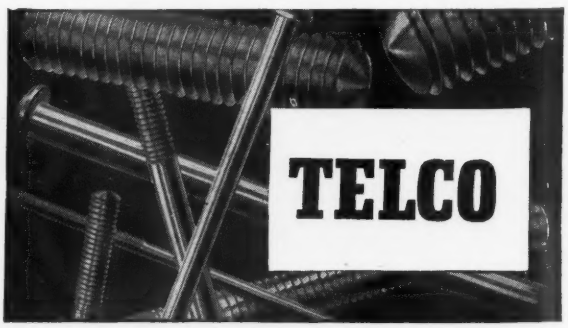

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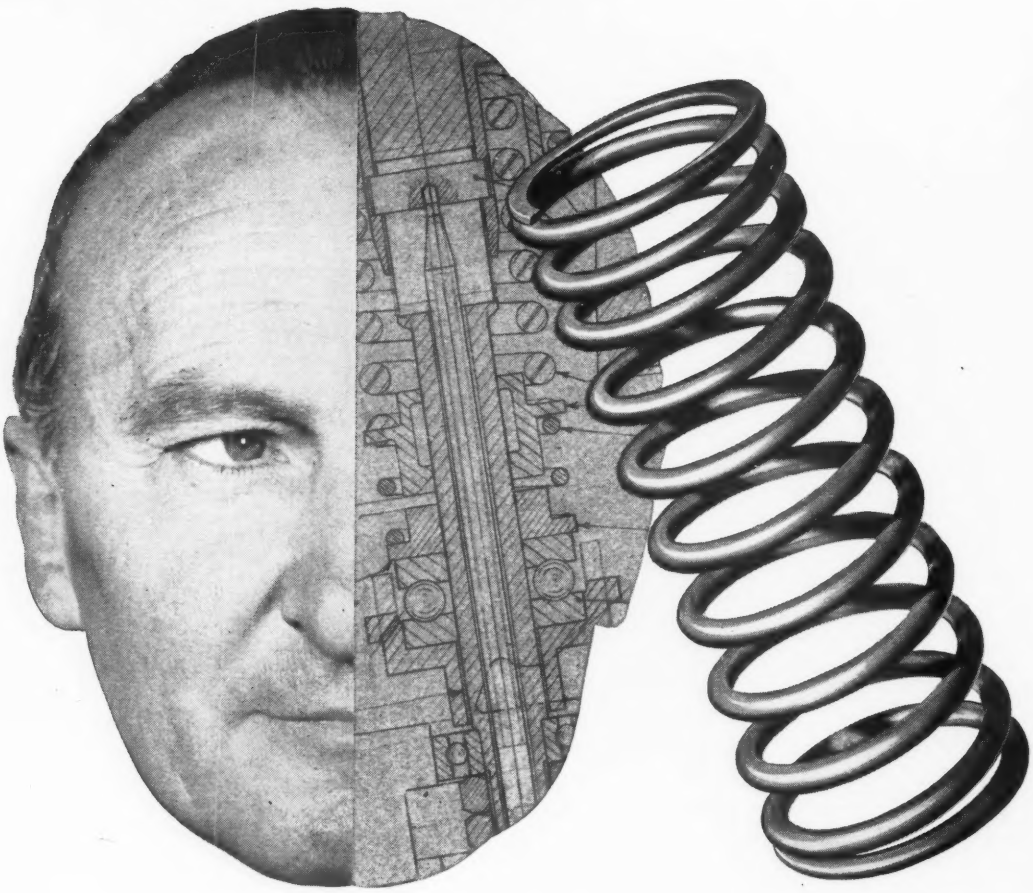

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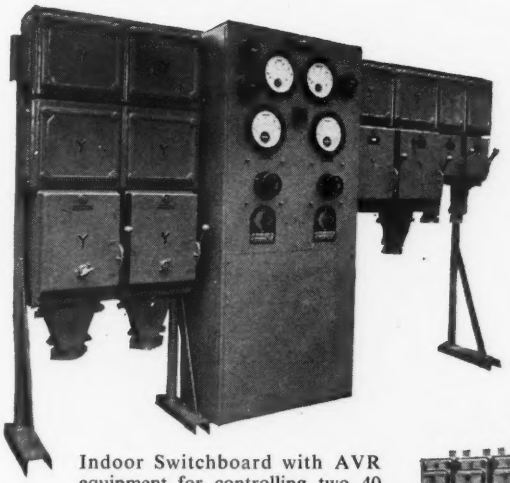
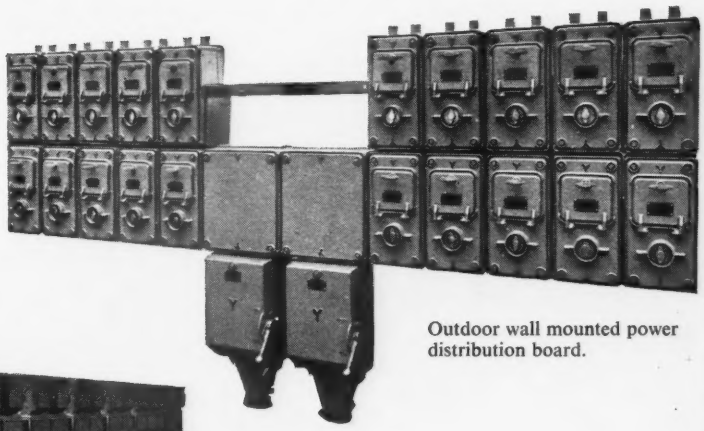
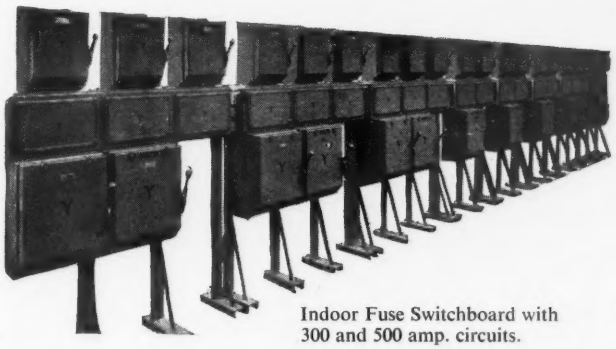


Indoor Switchboard with AVR equipment for controlling two 40 KW Alternators. Incoming Switch-fuses interlocked.



Outdoor wall mounted power distribution board.



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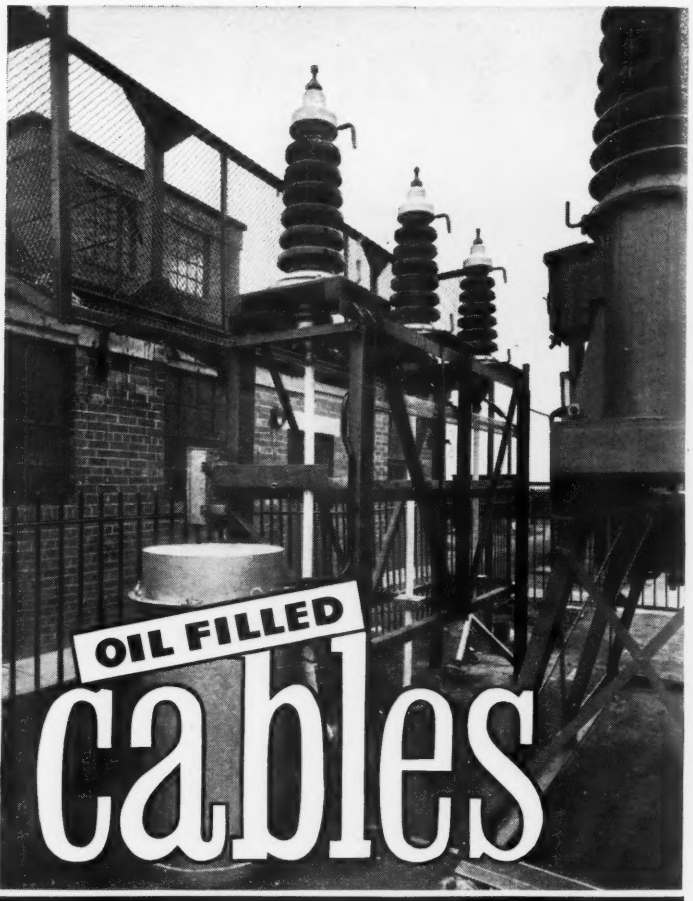

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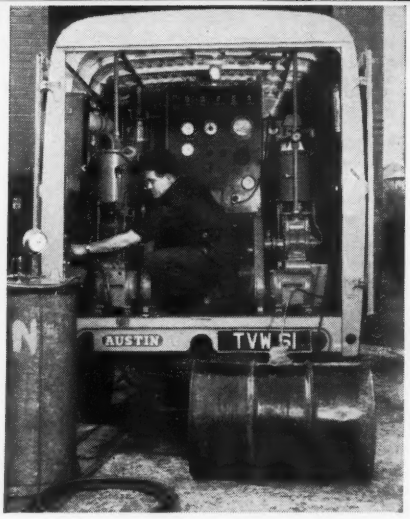

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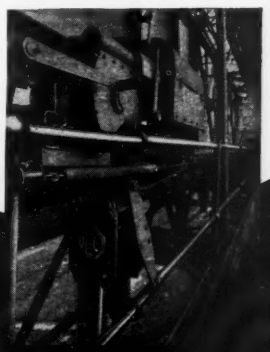

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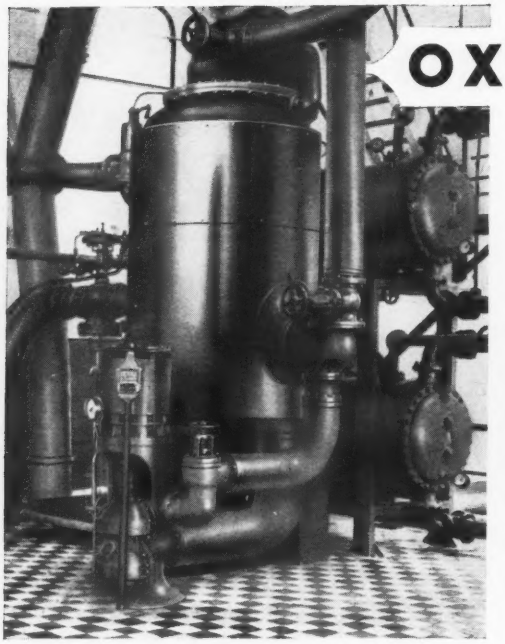

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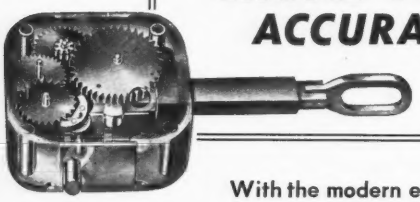

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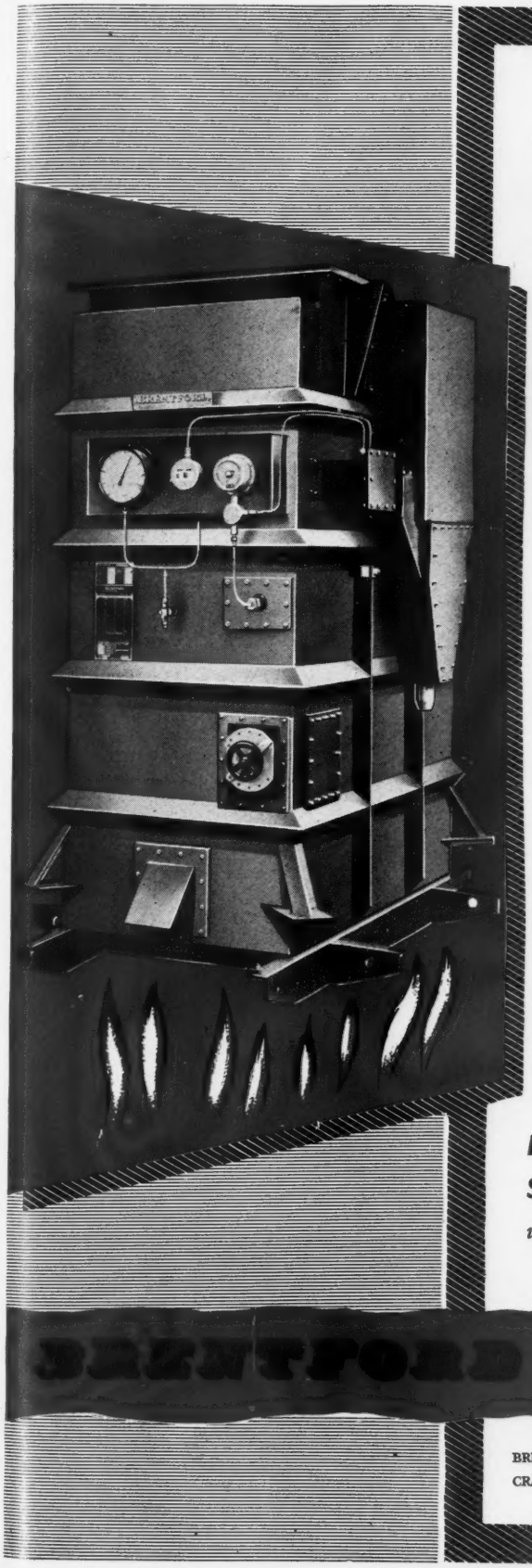

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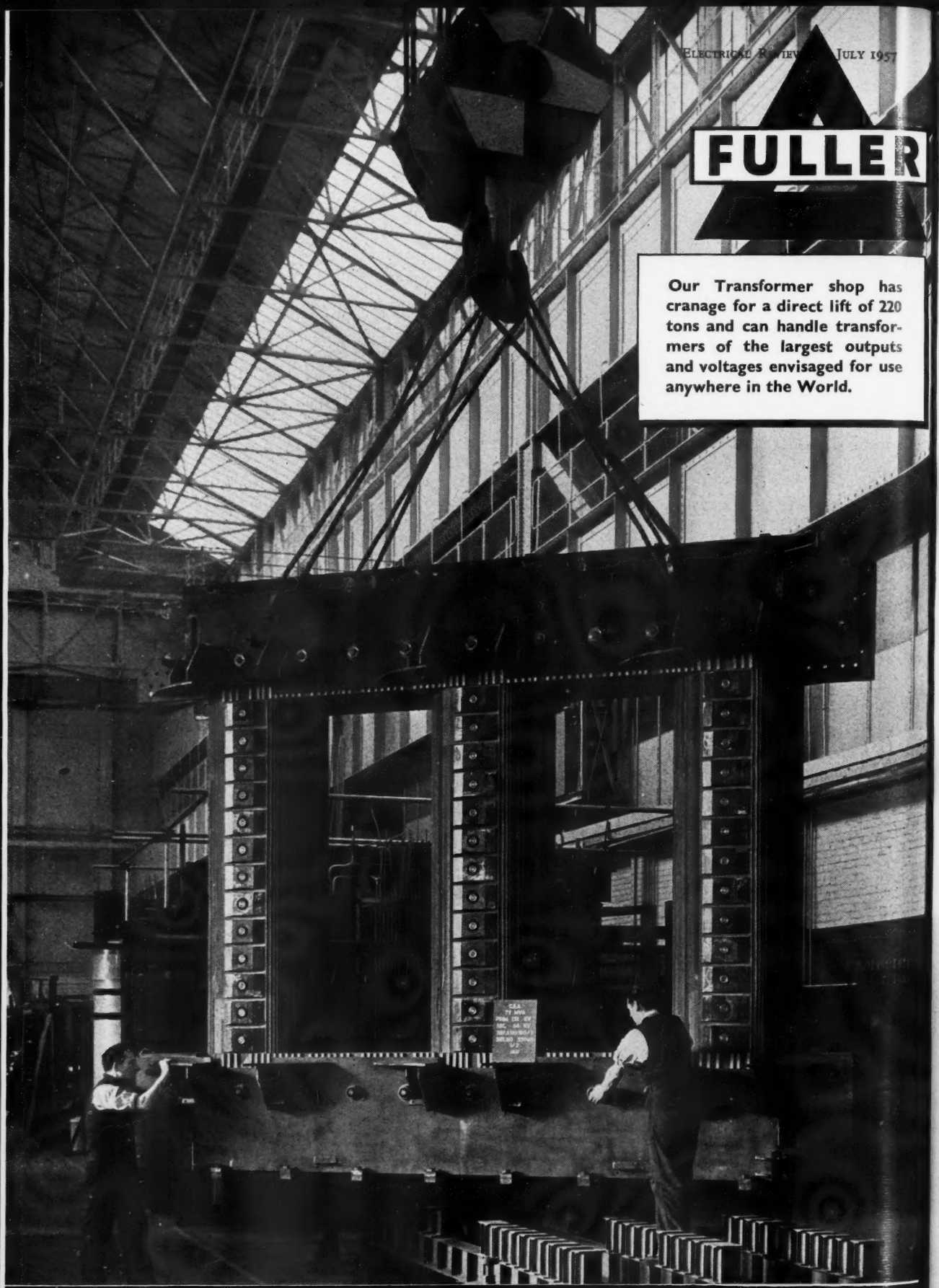

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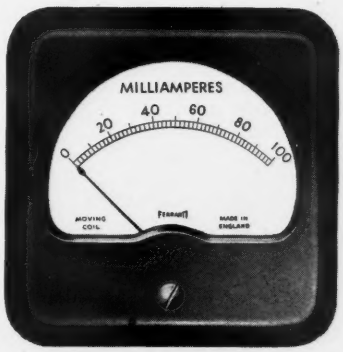

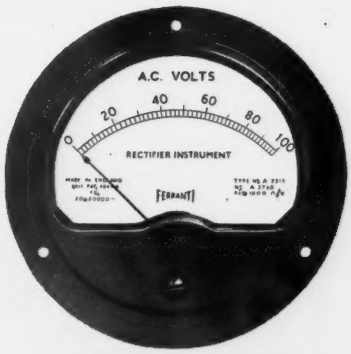

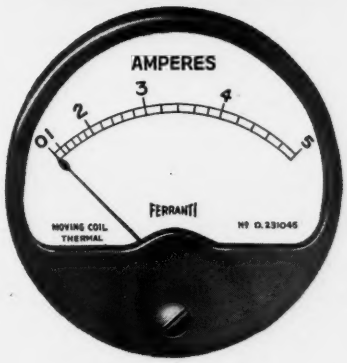

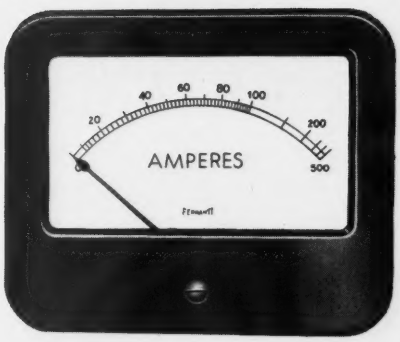

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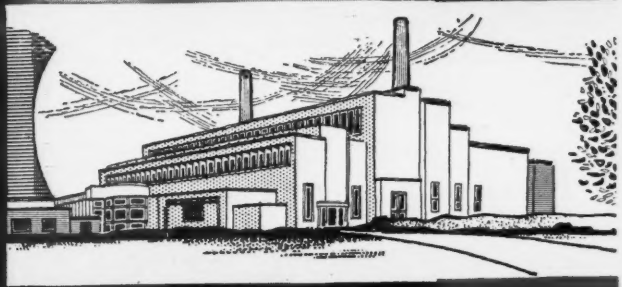

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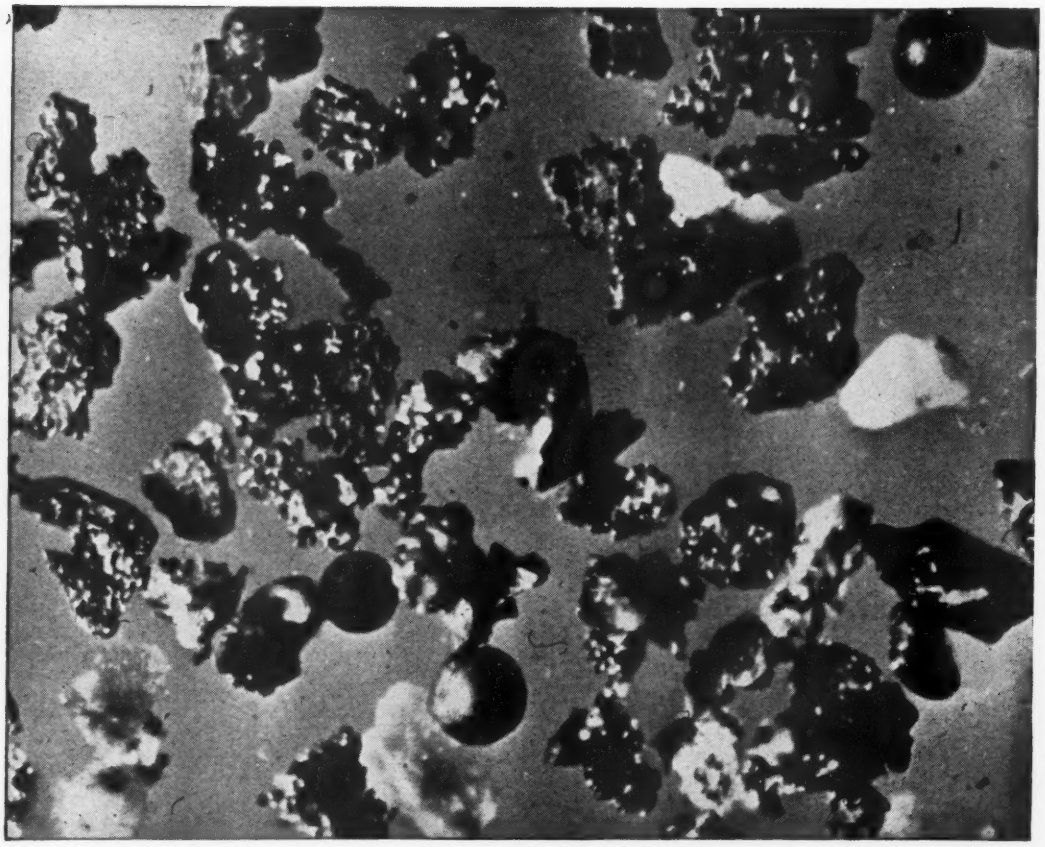

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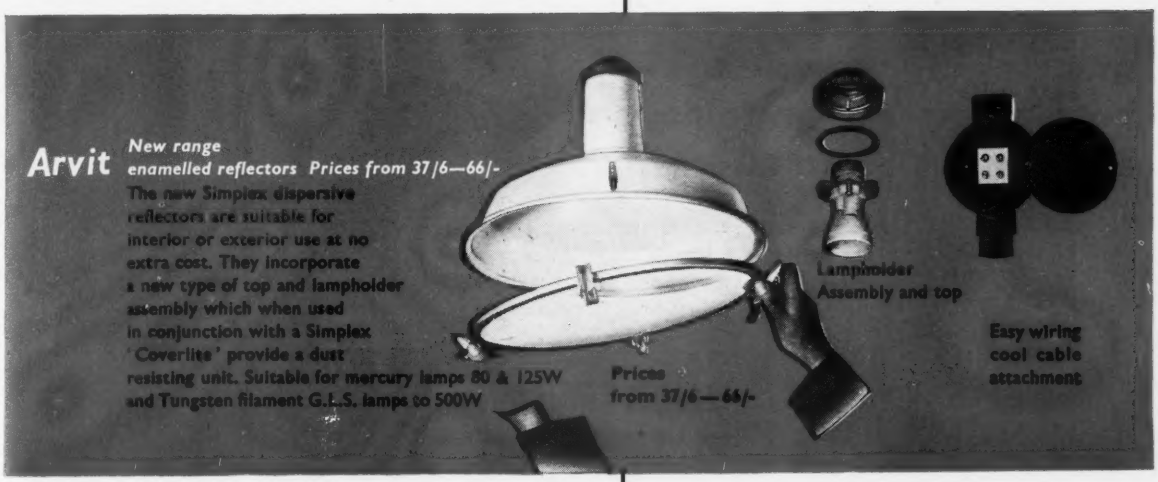
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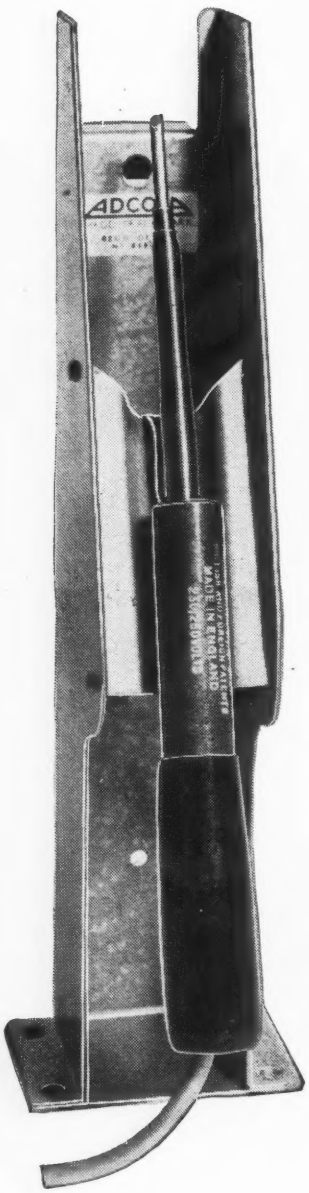

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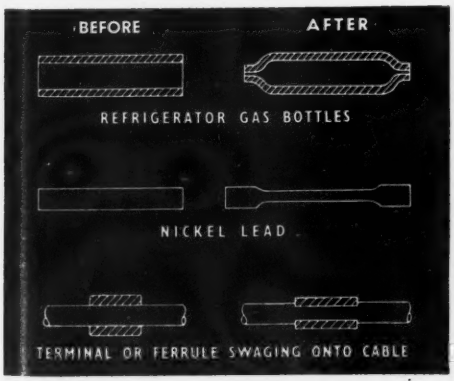

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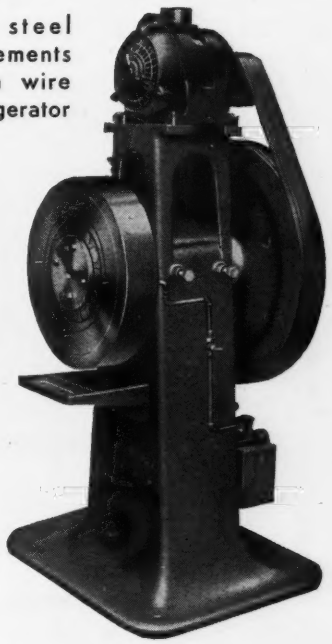

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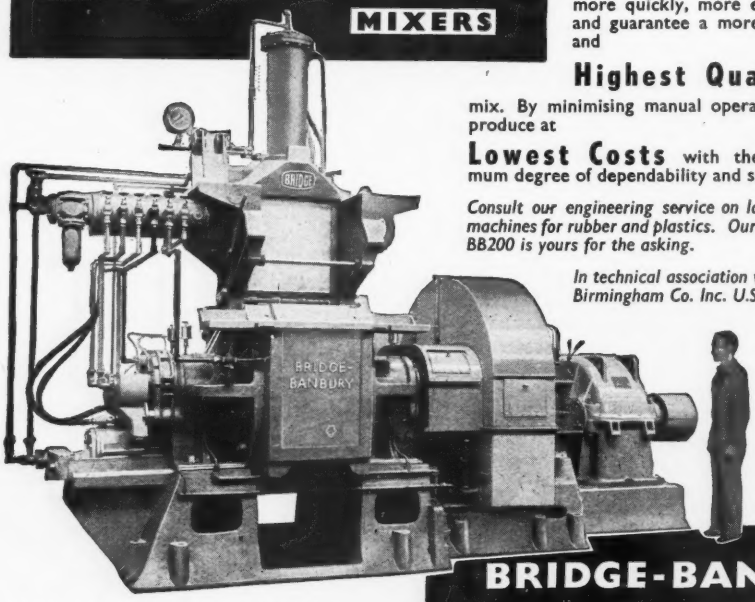

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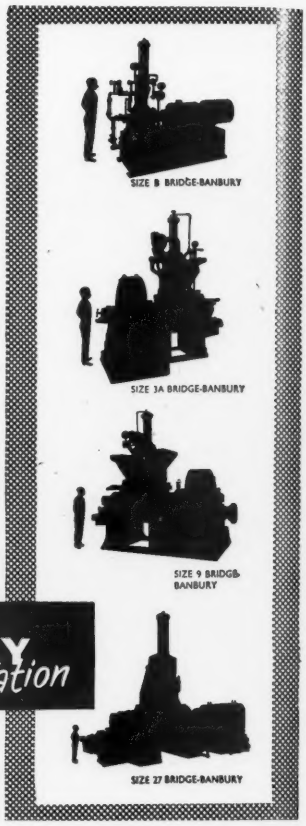

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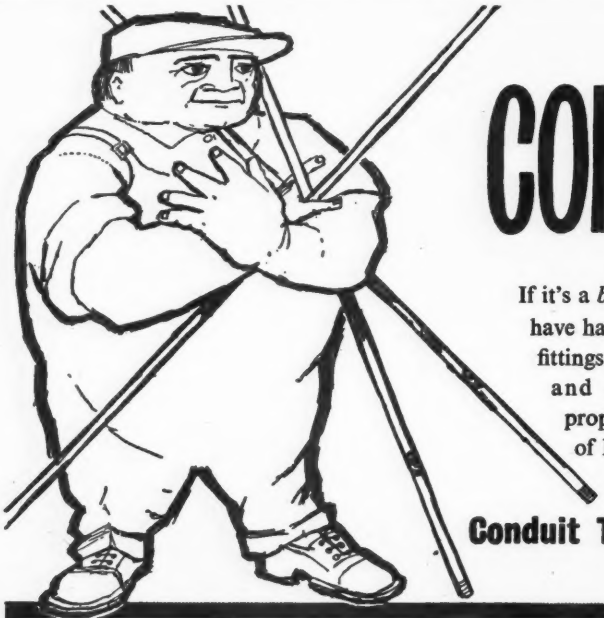

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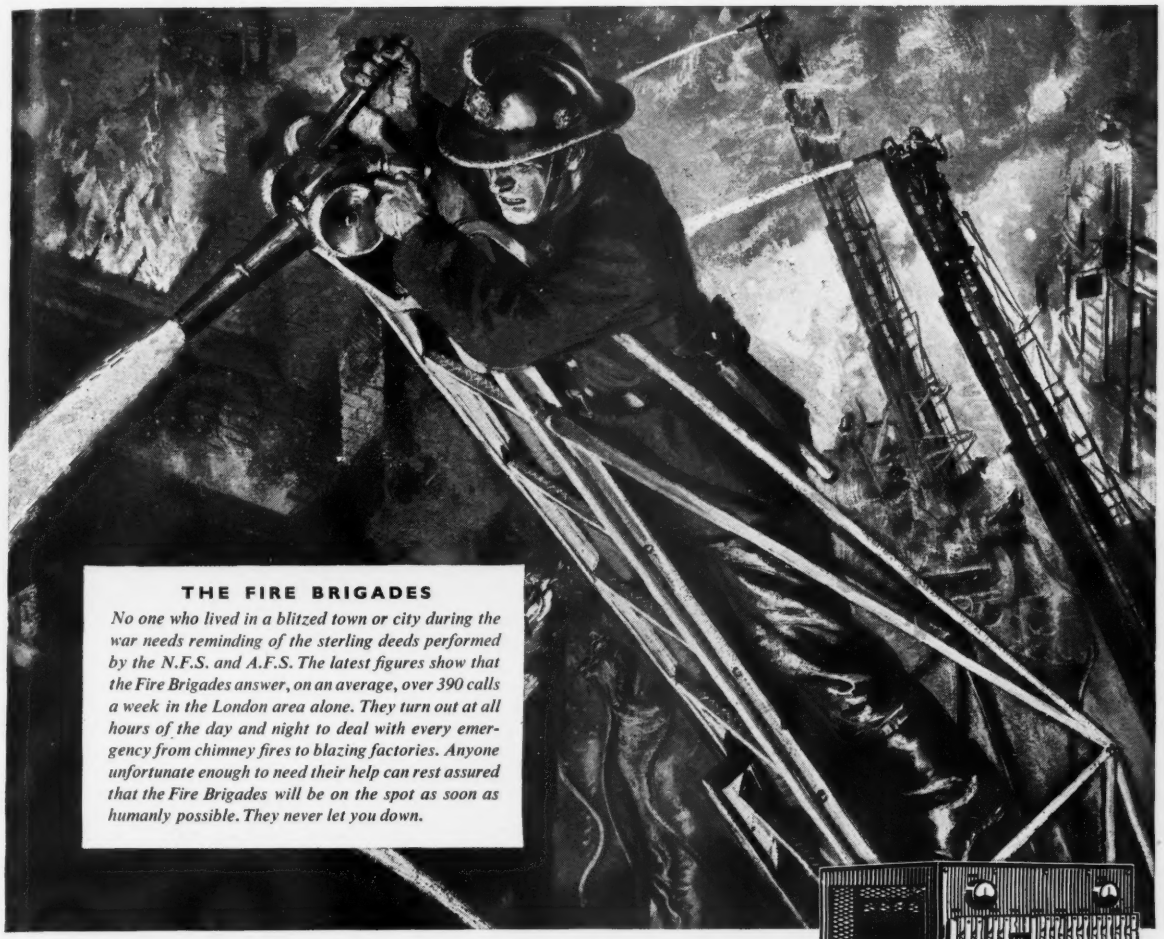

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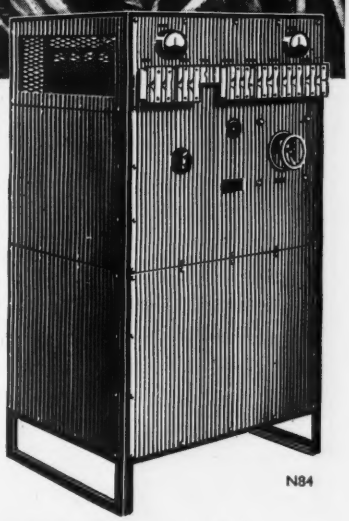

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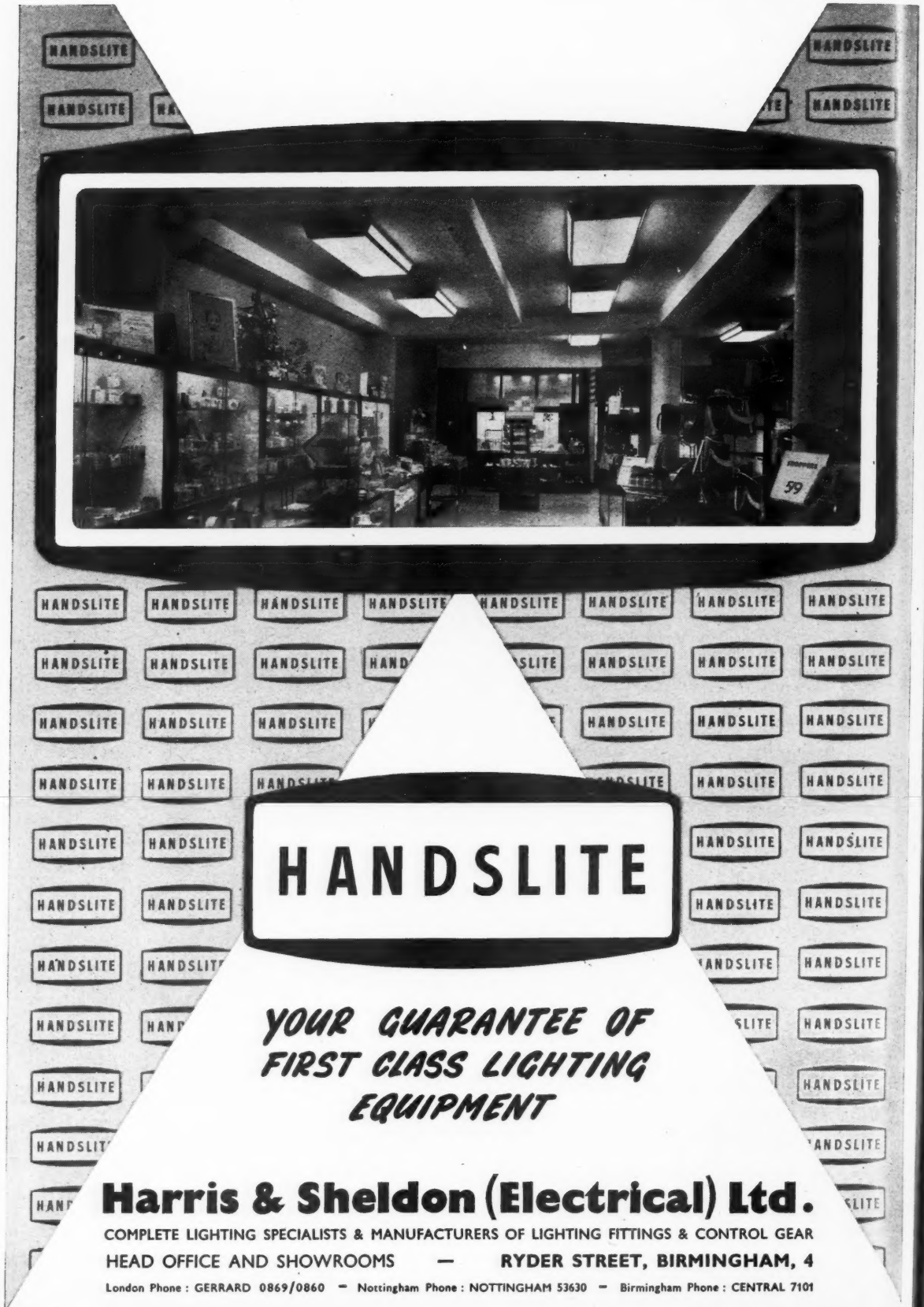
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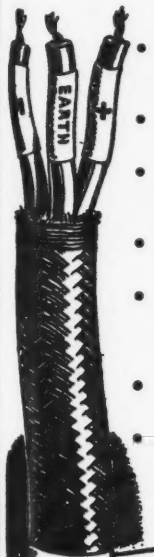
To follow the "Safety First" recommendation, make sure your electrical leads, whether to Domestic Appliances or to Machine Tools, etc., are clearly defined. "Viskrings" simply slipped over the core-wires and/or the outer casing of the leads do the job and put an end to confusion or doubt.



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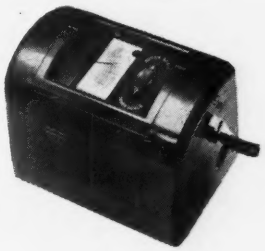

This instrument has been designed to bridge the price gap between the small Series 3 and the Series 2 instruments. It has the same voltage and megohm ranges as the Series 3 tester but has a constant pressure generator to ensure steady readings when testing cables having capacities or circuits fitted with suppressors.

Please write for Publication E.J.238.

★ Can also be supplied as an Insulation and Continuity Tester.

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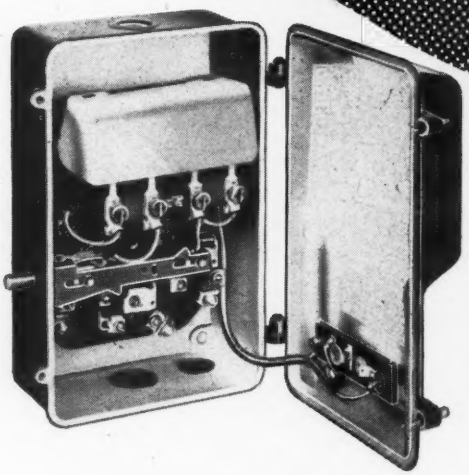

Type A30 Size 1 Direct-Switching Starter. Up to 7½ h.p.

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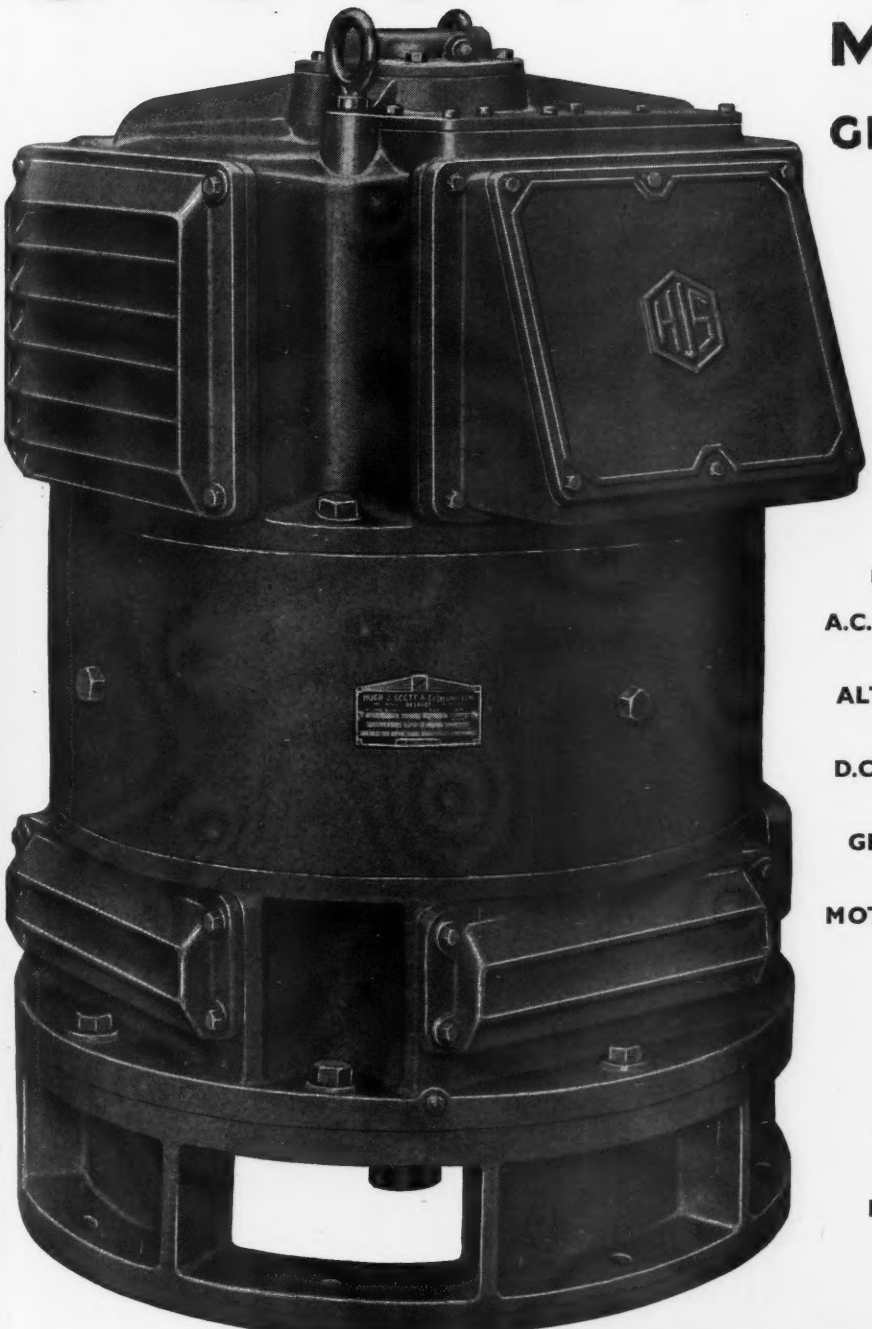

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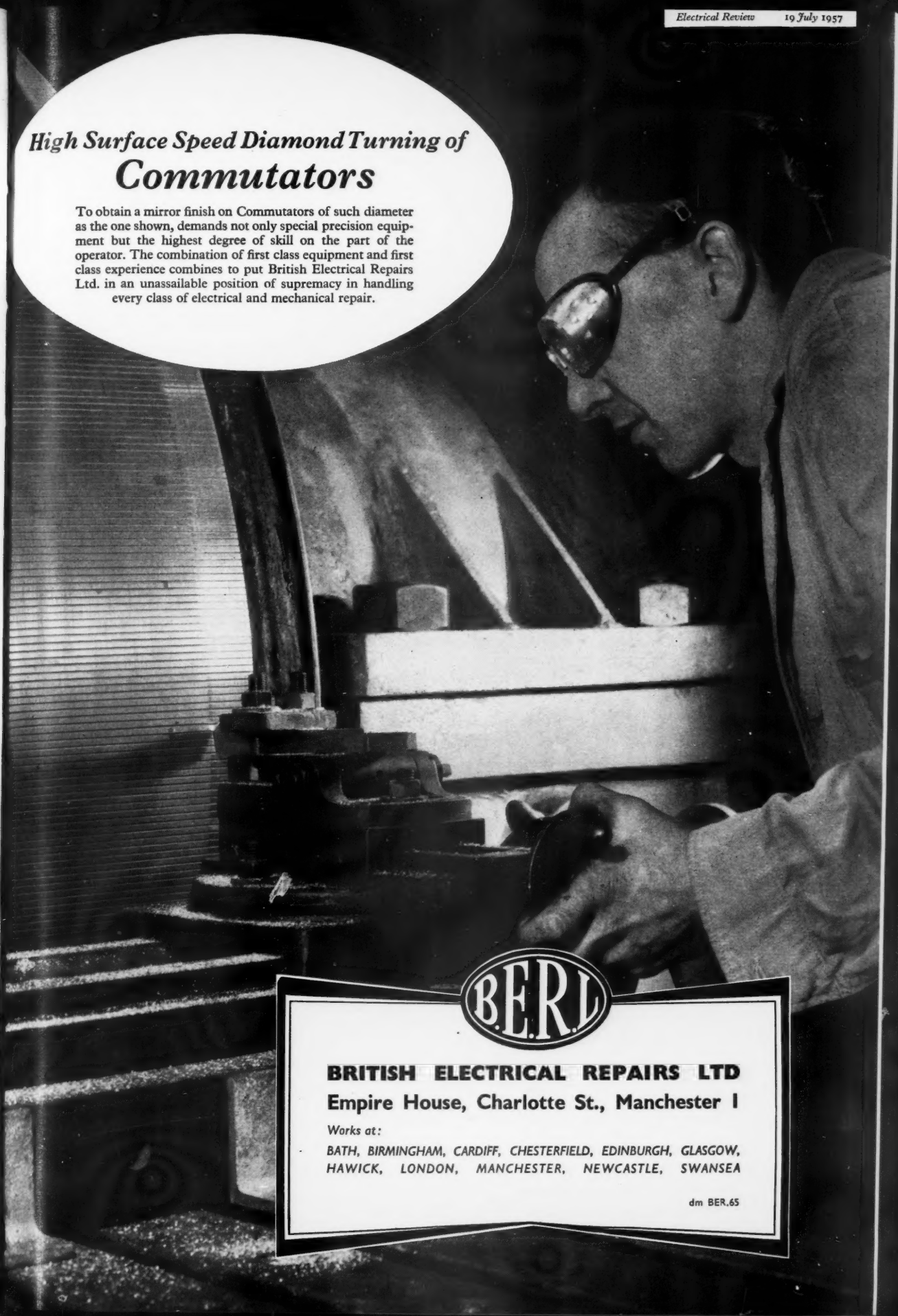

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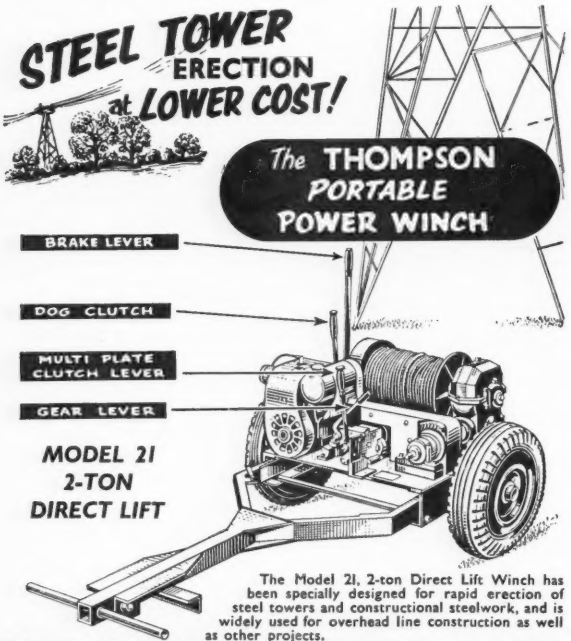

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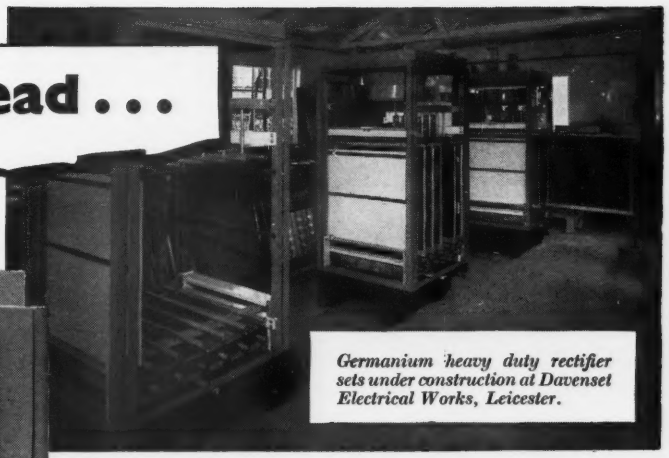
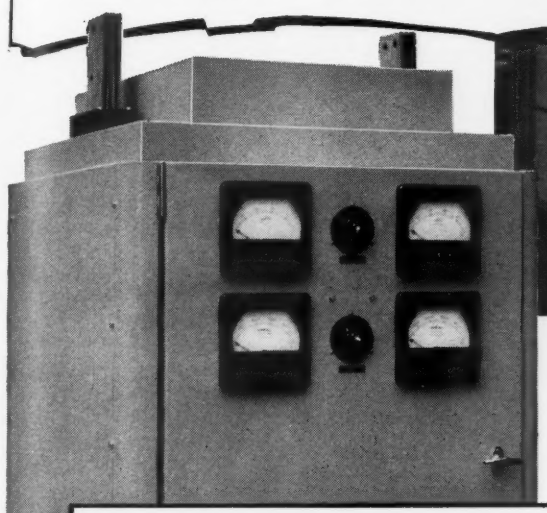


Germanium heavy duty rectifier sets under construction at Davenset Electrical Works, Leicester.



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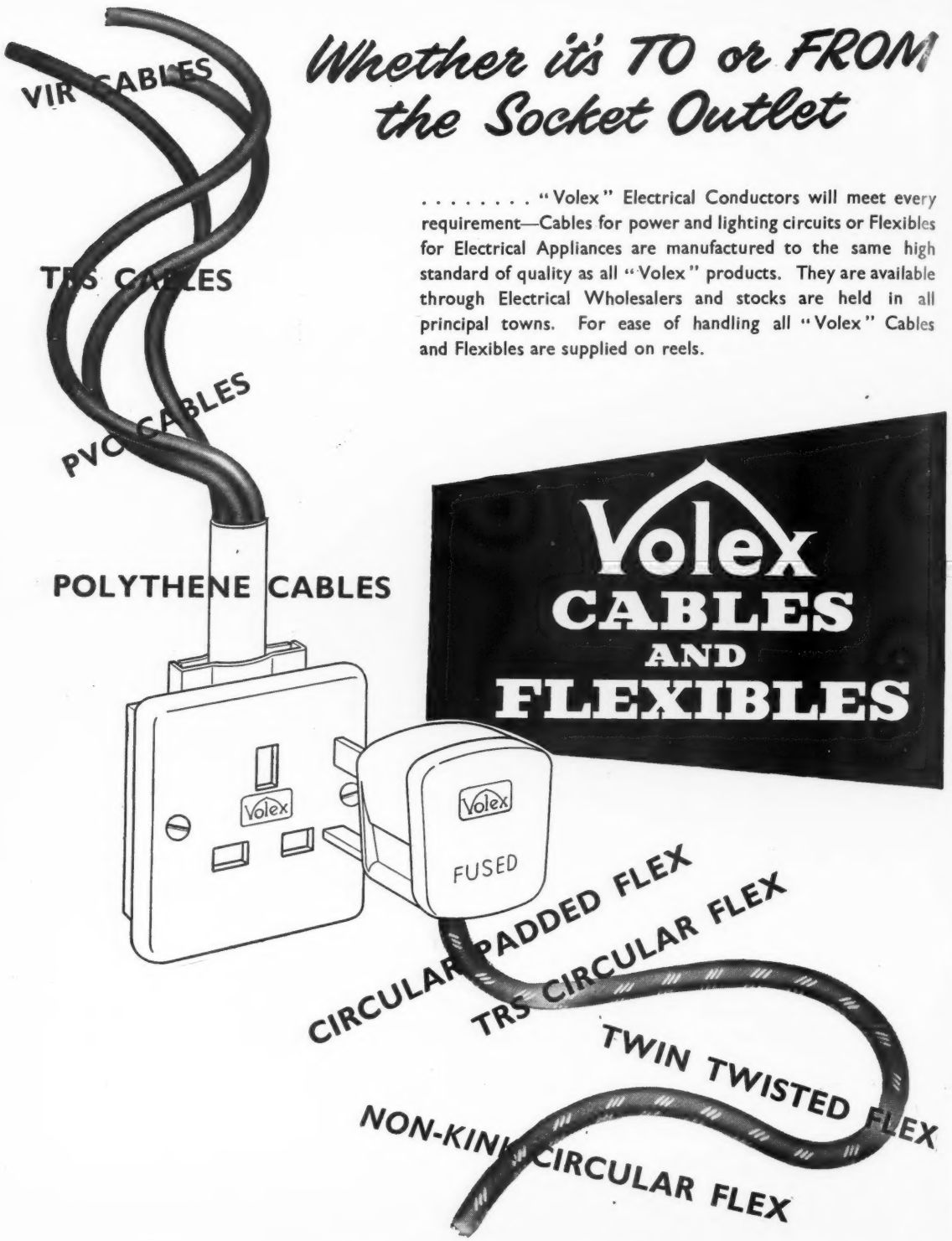

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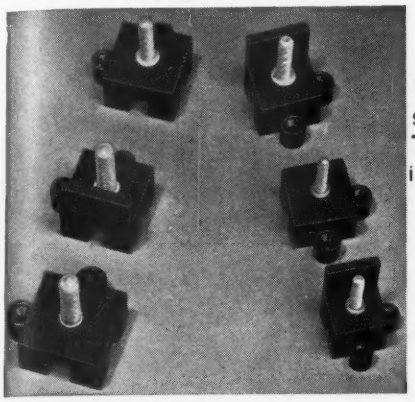

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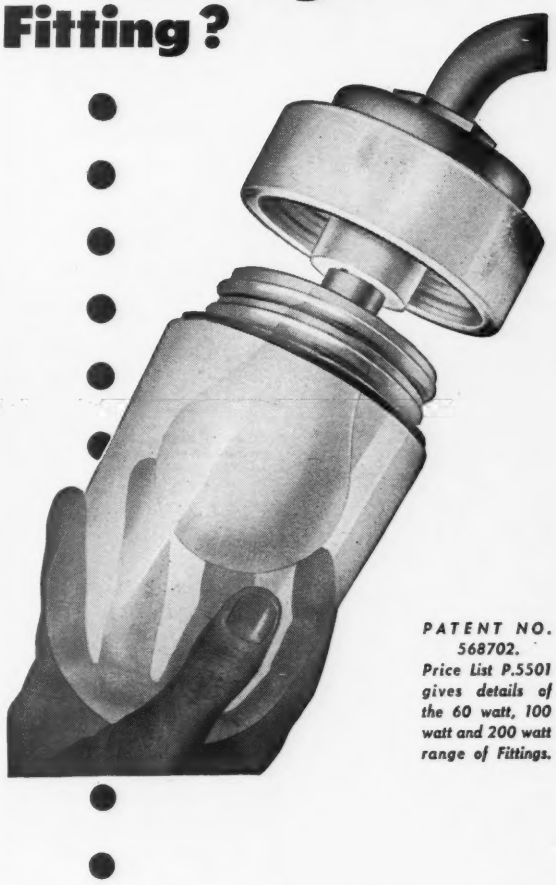

PATENT NO. 568702. Price List P.5501 gives details of the 60 watt, 100 watt and 200 watt range of Fittings.

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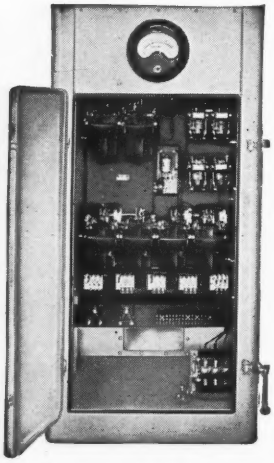

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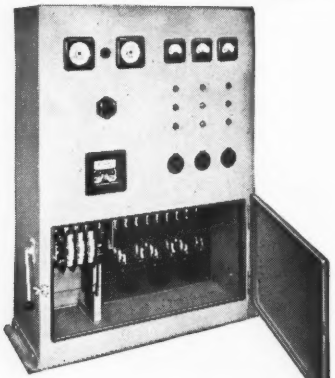

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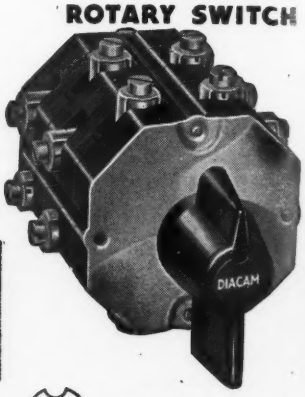
This 30-amp. rotary switch has solid silver contacts and a double-break on each pole, ensuring maximum efficiency and absolute safety under all conditions. Available in most sequences for either single or multi-pole switching.



This shows the patent terminal clamp securing two conductors

The specially engraved identity discs, also panel mounting indicator plates, can be supplied to customers' requirements

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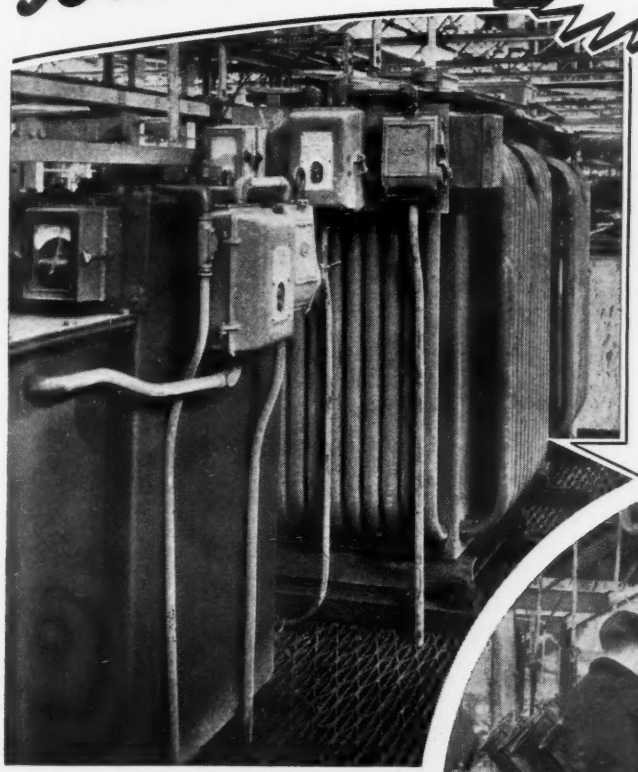

Westinghouse oil-immersed rectifiers with an output of 2,000 amperes at 16 volts d.c., supply power to the barrel plating plant of Ford Motor Company Ltd., Dagenham, for the copper, zinc and cadmium plating of small components.

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page 600

TURBO ALTERNATOR SETS

3,000 kW, 6,600/3,/50. Pass out, Condensing Turbo Alt. set by Met-Vick. Designed for 340 lb. W.P., initially 600° F. temp. Also suitable for the following duties:—

Output kW	*Pass out lb.hr.*	*Pressure*
3,000	60,000	40
1,800	40,000	110
1,800	40,000	110 and 40

Double Pass out at 1,000 kW fully condensing. Speed 1,000 r.p.m. through Reduction Gear.

2,500 kW (3,125 kVA) Turbo Alt. Set by B.T.H. for 440/3/50, 4 wire. Pressure 255 lb.sq.in. Turbine designed to operate as a Pass out set with quantities up to 55,000 lb.hr. at pressures 18/35 p.s.i.g. With Surface Condenser, circulating Pump, etc. Speed 3,000 r.p.m.

2,000 kW (2,350 kVA) Condensing Turbo Alternator set, by BELLISS & MORCOM/L.D.M., for 6,600/3/50. Steam pressure 180/250 lb.sq.in. Overload 25% for two hours. Surface Condenser mounted below Turbine.

(1,800/2,000 kW) Condensing or Pass out Turbo Alternator set by MET-VICK. Steam pressure 250 lb.sq.in., 650° F. Speed 1,000 r.p.m. through Reduction Gear. Alternator 400/3/50.

1,500 kW Turbo Alternator set by D. ADAMSON/BROWN BOUVERI. Steam pressure 230/250 lb.sq.in., 65/50 lb. back pressure. Alternator 400/3/50 4 wire. This set can be adjusted for steam pressures 150/160 lb.sq.in., 15 lb. back pressure.

1,000 kW Condensing, Geared Turbo Alternator set by ALLEN/E.C.C. for 400/3/50. Steam pressure 175 lb.sq.in., 600° F., exhausting to 29 in. vacuum. Speed 1,000 r.p.m. through Reduction Gear.

700 kW Pass out Condensing Turbo Alternator set by BELLISS & MORCOM/BRUCE PEEBLES for 400/440/3/50. Max. cont. rating 700 kW with steam at 190 lb.sq.in., superheat 100° F., exhausting to 28½ in. vacuum, passing out 8,000 lb. steam hr. at 10 lb. pressure, also bleed available for 2,000 lb. hr. at 50 lb.sq.in. Will develop 560 kW solely condensing. Driving through Reduction Gear 4,500 down to 1,000 r.p.m. Bruce Peebles Alternator. Turbine complete with condenser, cooling surface 910 ft., with direct driven Extraction Pump.

500 kW Turbo Alternator set by W. H. ALLEN/MATHER & PLATT for 400/440/3/50. Steam pressure 240 lb.sq.in., 100 lb. back pressure. Suitable for operation with steam down to 160 lb. against 30 lb. back pressure.

500 kW (625 kVA) Steam Turbo Alternator set by B.T.H. Impulse back pressure Turbine, steam pressure 300 lb.sq.in. 150° superheat exhausting against back pressure 60 lb.sq.in. Steam consumption 52·6 lb. kW hr. Speed 3,000 r.p.m. Steam regulating relay valves at steam chest operated through oil turbo motor, oil control through enclosed governor. Direct coupled to 500 kW Alternator, 440/3/50, 821 amps., 0·8 p.f., overhung Exciter rotor, Exciter 5 kW, 150 amps. max. 90 v. min. 200 v. With Switchboard. Overall dimens. 15 ft. × 7 ft. × 8 ft. 6 in. high.

500 kW (625 kVA) Pass out, Condensing Steam Turbo Alternator set by BELLISS & MORCOM/E.E.C. for 400/3/50. Turbine designed for 750 h.p. at 600 r.p.m. with steam at 190 lb.sq.in., superheat 150° F., passing out 10,000 lb. hr. at 60 lb.g., balance exhausting to condenser, vacuum 28½ in.

350 kW W. H. ALLEN/L.D.M. Geared Turbo Alternator Set, 180 lb. pressure, 575° F.; pass out 13,000 lb. per hour at 25 lb. pressure; remainder exhausting to condenser. Alternator 400/440/3/50, 4-wire.

300 kW (400 kVA) Turbo Alternator set by ALLEN/HARLAND. Steam pressure 275 lb. against 48 lb. back pressure, superheated 535° F., 25% overload for 2 hrs. Could be arranged for operation at 160 lb.sq.in. 10 lb. back pressure. Speed 8,000/1,000 r.p.m. through Reduction Gear. Alternator 400/3/50.

ECONOMIC BOILERS

Single Pass Boiler by Foster Yates & Thom, 16 ft. over tubes × 10 ft. 6in. dia. × 22 ft. 9 in. overall. Evap. 15,000 lb.hr. from and at 212° F. when fired with good quality fuel. W.P. 150 lb.sq.in. With Bennis air draught Stoker. Induced draught fan driven by Reader steam engine. Boiler by Stockton Chemical Engineers & Riley Boilers, 15 ft. over tube plates × 6 ft. int. dia. Evap. 4,000 lb. hr. at 212° F. W.P. 225 lb.sq.in.

Self contained Double Pass Boiler by Rankin & Blackmore, 14 ft. 6 in. overall × 12 ft. over tube plates × 7 ft. 3 in. dia. Evap. 4,000 lb. hr. F. & A. 212° F. Pressure 250 lb.sq.in. Single flue fitted Hodgkinson Low Ram Stoker. Steel chimney 27 in. dia.

Two Super Economic Boilers by John Thompson, treble pass type, 14 ft. over tubes × 9 ft. 6 in. diam. × 19 ft. overall. Evap. 9,500 lb. hr. at 212° F. when stoker fired, 9,900 lb. when oil fired. W.P. 120 lb.sq.in. Fitted Superheater to give final temp. 445° F.

Self contained Economic Boiler by Edwin Danks, 13 ft. 6 in. overall × 10 ft. 6 in. over tube plates × 5 ft. 6 in. diam. Evap. 2,000 lb. W.P. 60 lb.sq.in. With Worthington Simpson Boiler Feed Pump.

Single pass Economic Boiler by Foster, Yates & Thom, 22 ft. 9 in. overall × 16 ft. over tube plates × 10 ft. 6 in. diam. Evap. 12,500 lb. hr. at 212° F. W.P. 150 lb.sq.in. Fitted Superheater giving final temp. 445° F. and John Thompson Triumph Shovel Stoker.

Three Treble Pass Economic Boilers by Edwin Danks, 10 ft. 6 in. diam. × 11 ft. 6 in. over tubes × 16 ft. 6 in. overall. Evap. 11,620 lb. hr. at 212° F. fired with good coal or 12,200 lb. hr. at 212° F. when oil fired. Steam drum 5 ft. × 42 in. diam.

Six self contained Treble Pass Boilers by Marshall, 9 ft. 6 in. over tube plates × 12 ft. overall × 8 ft. diam. Evap. 4,250/5,200 lb. W.P. 100 lb.sq.in.

Self contained Boiler by Danks, 11 ft. over tube plates × 6 ft. dia. Evap. 2,500 lb. hr. W.P. 150 lb.sq.in. Fitted ' Rotamiser ' oil burning equipment by Combustions, Ltd., Mowbrey controls, Weir Feed Pump 600 g.p.hr. and Steel Chimney 2 ft. dia. × 55 ft. with guys.

New Size No. 6 ' Farratube ' Economic Boiler, 13 ft. 9 in. over combustion chamber × 10 ft. 6 in. over tube plates × 6 ft. diam. Evap. 2,800 lb. at 212° F., or 2,340 lb. at 60° F. W.P. 100 lb.sq.in.

Davey Paxman Treble Pass Ultranomic Boiler 13 ft. 9 in. overall, 9 ft. 3 in. between tube plates × 8 ft. dia. W.P. 160 lb.sq.in. Evap. 4,000 lb. at 212° F.

Size No. 10 self contained Economic Boiler by Robey & Co., 18 ft. 10 in. overall × 14 ft. 6 in. over tube plates × 8 ft. 6 in. dia. Evap. 8,000 lb. at 212° F. W.P. 120 lb.sq.in. Two flues each 34 in. diam. fitted hand fired Turbine patent F.D. Furnaces. With Worthington Simpson Feed Pump and motorized Forced draught Fan.

WATERTUBE BOILERS

Size No. 8 Fraser & Fraser Watertube Boiler. Evap. 2,500 lb. hr. at 120 lb.sq.in. W.P. With Oil burning equipment by Urquhart, Ltd., also Fuel storage Tank for 2,750 gal., Boiler Feed Pump and 60 ft. Chimney.

Two Babcock & Wilcox Boilers, W.I.F. type, arranged as pair, heating surface 3,580 sq. ft. each. Evap. 12,500 lb. each normal, up to 16,000 lb. forced. W.P. 170 lb.sq.in. Superheater 396 sq. ft. heating surface each has two horiz. steam drums 24 ft. × 3 ft. 6 in. dia. With Babcock & Wilcox Chain Grate Stokers if required.

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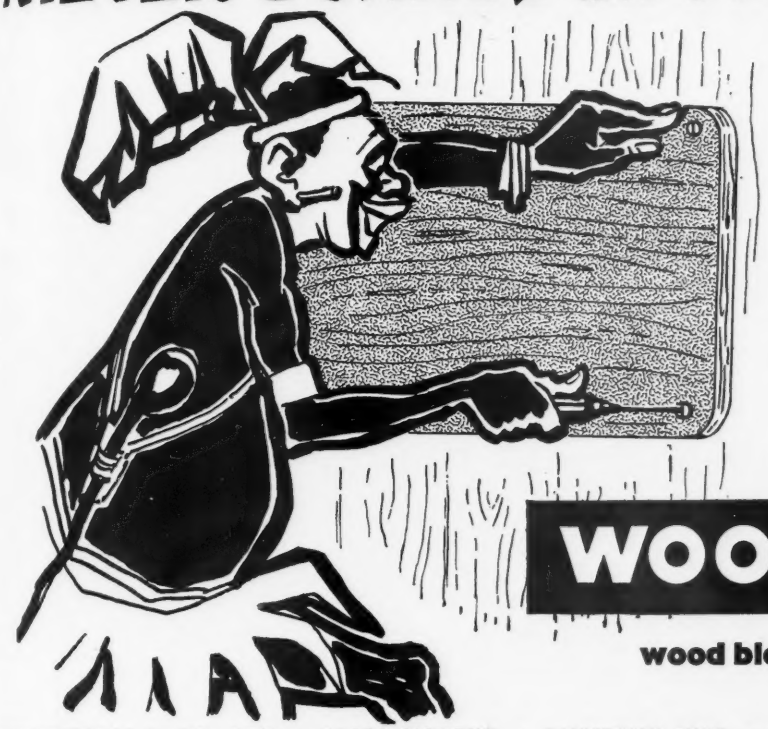

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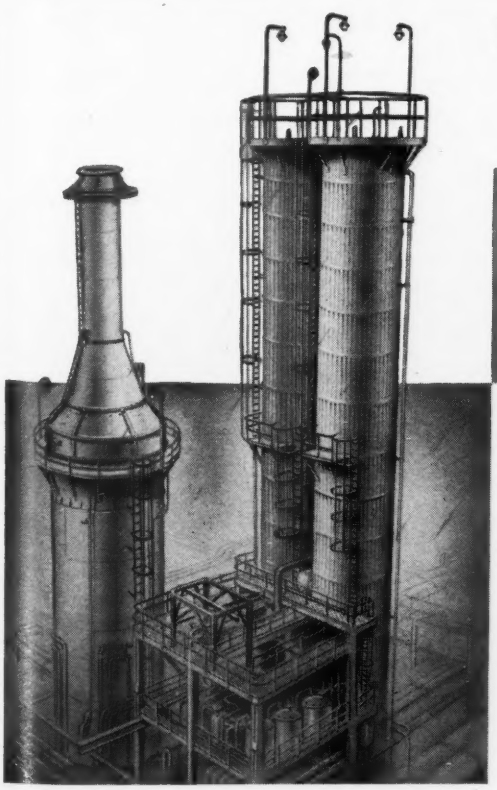

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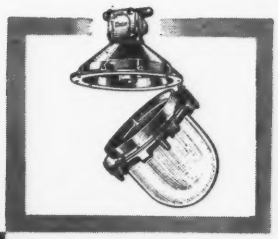

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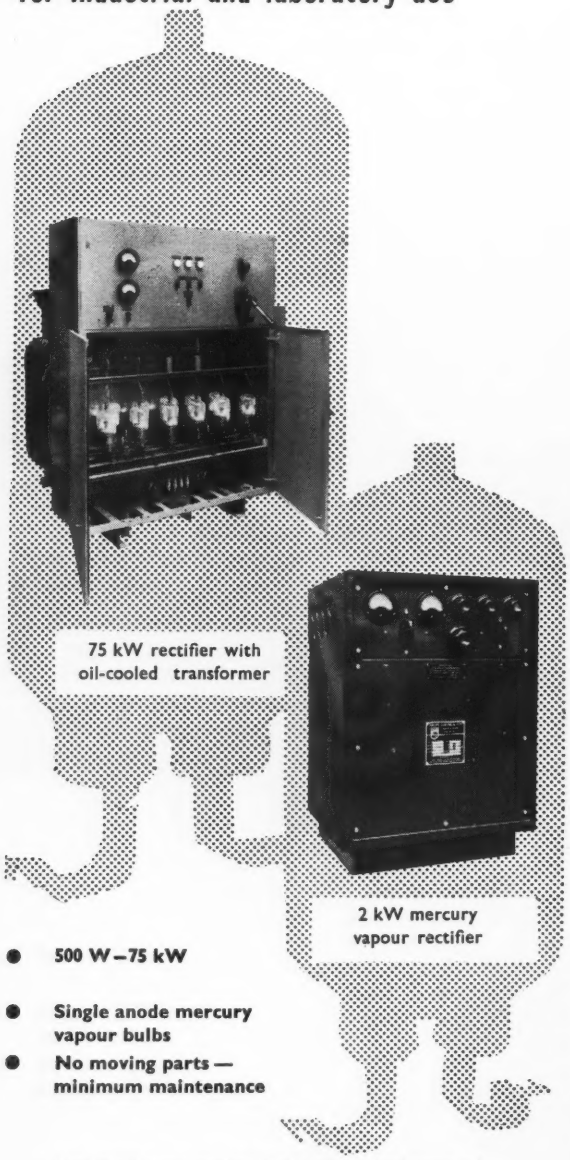

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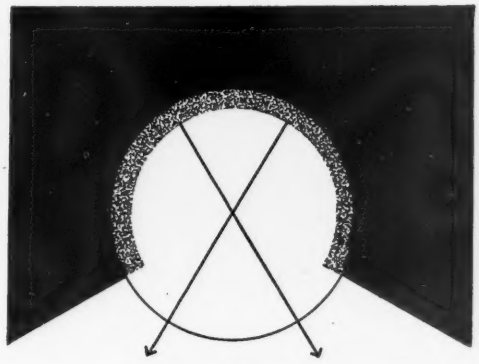

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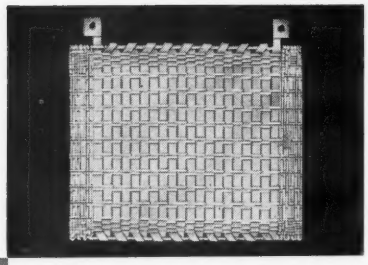

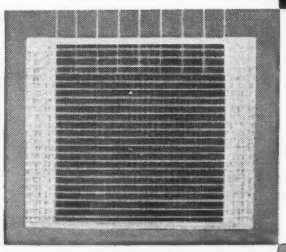

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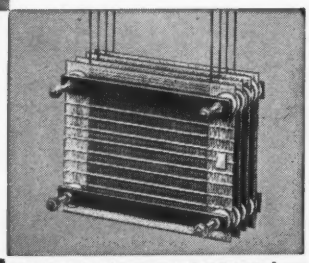

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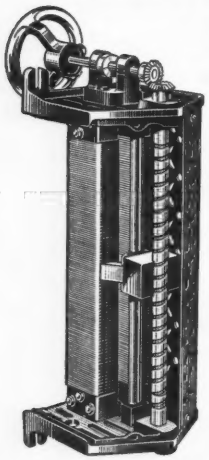

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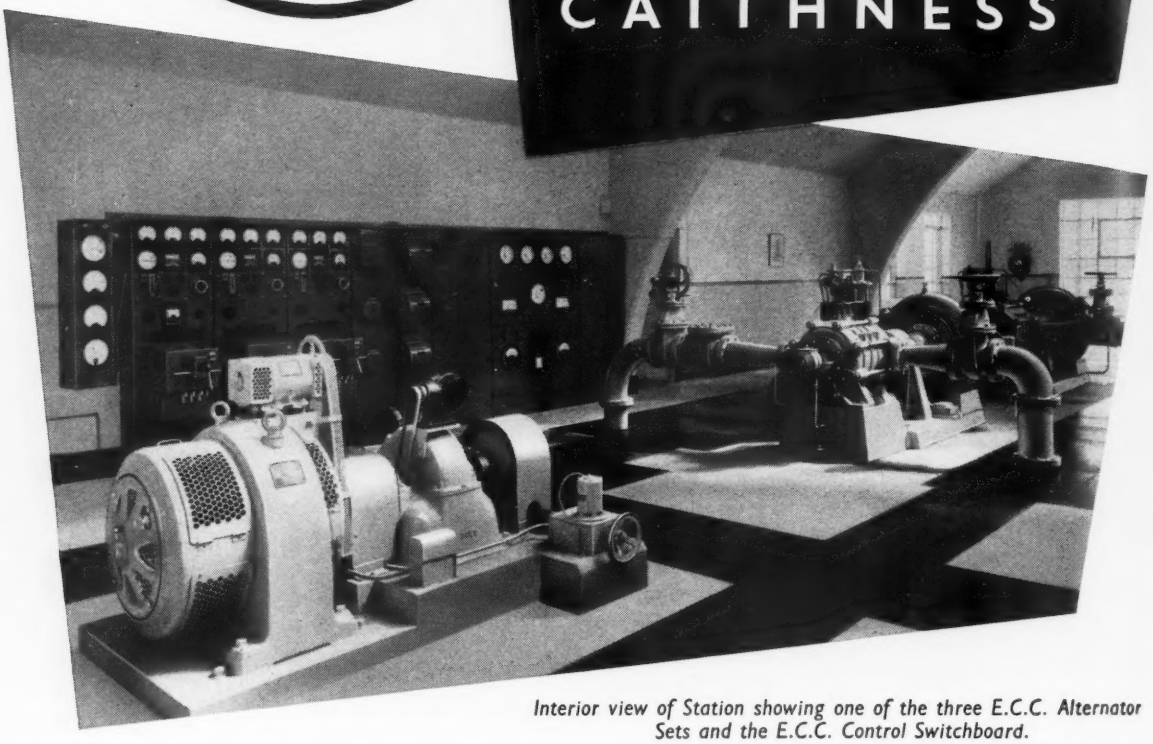

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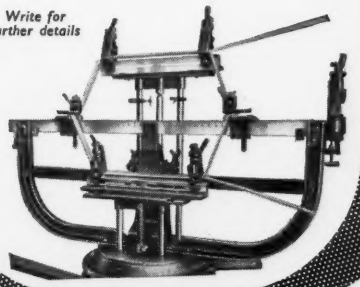

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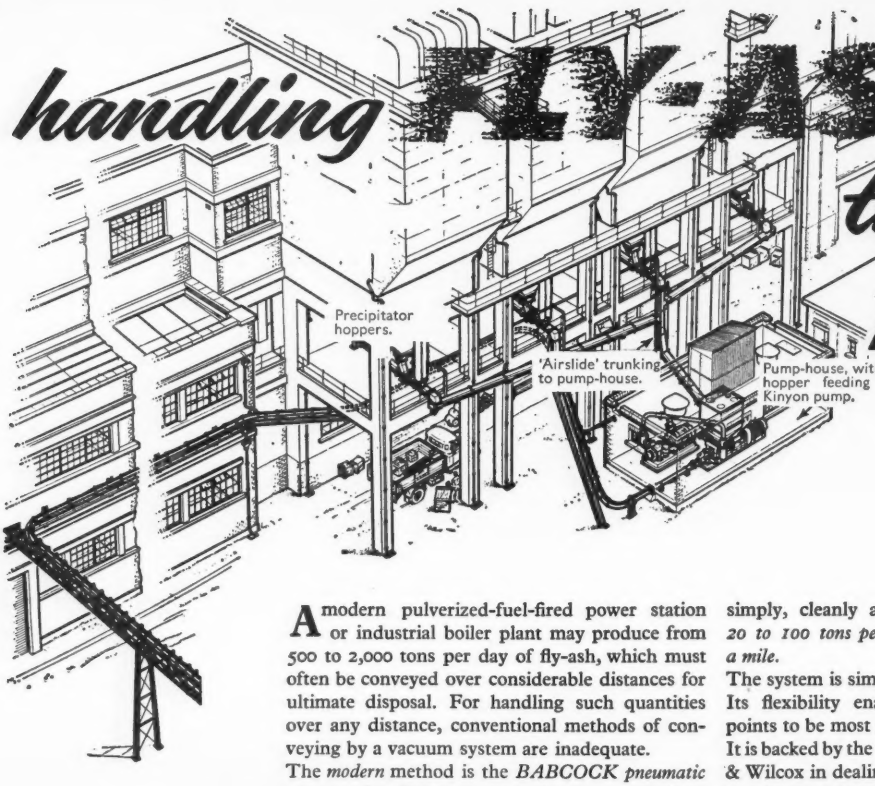

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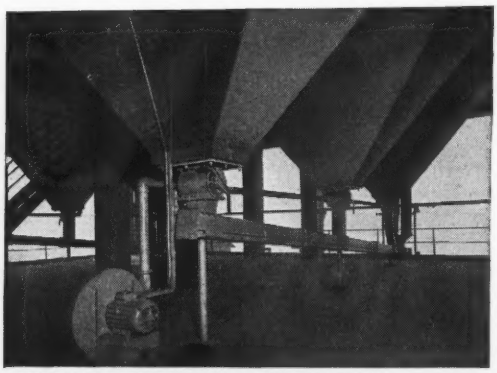
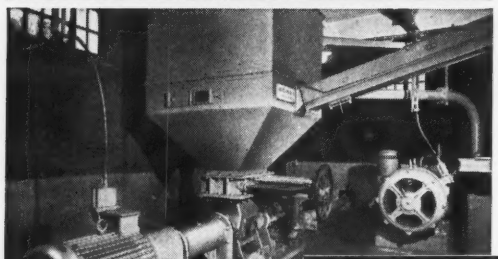
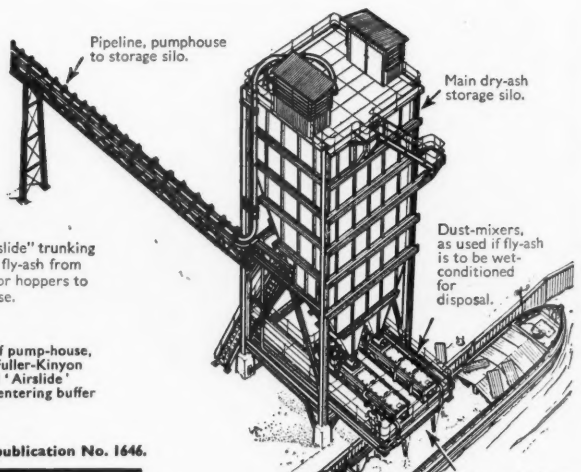




Above left:
Main "Airslide" trunking conveying fly-ash from precipitator hoppers to pump-house.

Left:
Interior of pump-house, showing Fuller-Kinyon pump and 'Airslide' trunking entering buffer hopper.


Pipeline, pumphouse to storage silo.
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19 JULY
1957

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

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✧ ✧ ✧ ✧

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VOLUME 161 NUMBER 3 ✧ *Eighty-Fifth Year of Publication* ✧ FRIDAY PRICE 1s 6d

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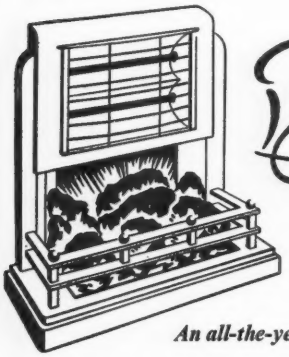

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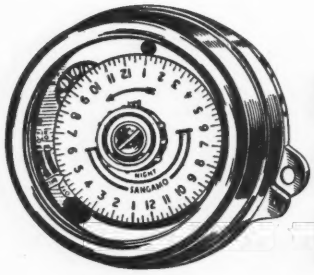

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ELECTRICAL REVIEW

19 July 1957 Vol. 161 No. 3 Established 1872

The Academic Background

WE are not really very surprised that there are some misunderstandings with regard to the requirements for admission to corporate membership of the Institution of Electrical Engineers. Earlier this year we received an article for publication (from what could be regarded as an authoritative source in the academic electrical sphere) which showed much misconception about the qualifications demanded of the prospective chartered electrical engineer, the real aims of the I.E.E. examination, and the conditions of exemption from the examination. This led us to make inquiries in various directions and we suspect there is a widespread ignorance of these matters.

Since the Duke of Edinburgh drew attention some years ago to the serious lack of qualified technologists there have been introduced rapidly all sorts of schemes of revised training and qualifications by the Government, the universities, colleges and schools, the learned institutions and societies and, also of importance, by industry in general and the electrical industry in particular. We ourselves confess to having been somewhat confused by the rapid introduction of all these schemes, but we are convinced that they have all contributed and are still contributing to a more settled state of affairs.

All the same, ignorance with regard to the academic background is so serious for the profession and industry as a whole that we have appealed to the highest authoritative source electrically—the Institution of Electrical Engineers—with the result that we publish in this issue the article on " Professional Qualification " by Mr. T. E. Goldup who is the next President of the Institution.

We wonder, however, whether the author has made clear the basis on which the I.E.E. examinations are set and exemptions are granted. This thought is prompted by the distinction between the professional engineer and the technologist. The professional engineer is, if our interpretation of the definition is correct, the man who has a broader grasp of what his subject is about, whereas the technologist, however expert, is expected to be only concerned with the field of application of the ideas of the professional engineer. The academic backing necessary for the two classes is of the utmost importance.

Among many aspects of the question there are two which are so prominent that they may overshadow all other considerations in the squaring-up of the present-day qualification position: these are the serious shortage of technologists and the somewhat alarming rapidity with which new techniques are developing. This might form the subject of a further article. However that may be, we believe that Mr. Goldup's contribution should be regarded as a great service to the electrical profession and industry.

INDUSTRY AND EDUCATION

Although, as we say in our leading article, the shortage of technologists is still serious, in the past few years there has been an improvement in the position which is tending to encourage a cautious optimism, and much of this improvement has been due to industry. It was the growth of industry in the 19th century which resulted in the establishment of the learned engineering institutions and again it is the growth of industry which is calling for greater qualifications.

But it is most obvious now that industry has not stood still and has been active even to the extent of helping to increase the number of science students coming up from the schools, which we have claimed all along is the crux of the problem. Within the last few days a case has come to our notice of a large grammar school in the South of England being granted about £19,000 towards the provision of new chemistry and physics laboratories from the Industrial Fund for the Advancement of Scientific Education in Schools. This is but one example of the good work which is being done by the Fund to which many electrical concerns are contributors.

THE E.I.B.A.'s NEEDS

Last year the accounts of the Electrical Industries Benevolent Association closed with a balance of £6,500 on the wrong side. As was pointed out by Mr. H. Riley, the president, at last Friday's annual meeting, this was not because of a fall in income but arose from the extension of the Association's work. That work must continue to grow in an ever-expanding industry, but one would think that income would increase correspondingly. Actually it does not, in spite of the endeavours of so many devoted people to enlist the aid of those in the industry who may or may not one day need the Association's assistance.

More might be done by the managements of electrical concerns to interest their staffs in the work of the Association as well as themselves contributing towards the funds. Those firms and individuals who are already regular subscribers might ask themselves whether the size of their contributions has kept up with the rising costs of everything, which is one of the causes of the Association's financial tightness.

NOT GOOD ENOUGH

In the booklet " Freer Trade for Europe " published by the Stationery Office the introductory section deals with the European Economic Community formed by Belgium, France, Germany, Italy, Luxembourg and the Netherlands. It is said that by forming a common market these six countries would make possible production on the American scale. The report of a committee set up by the six is quoted and one remark reproduced is:—

> " in the field of atomic science, the knowledge acquired at great cost in several European countries represents but a feeble fraction of the knowledge which the United States now places freely at the disposal of their industry and that of other countries."

The opening part of this sentence gives a quite false picture, if the countries referred to include Great Britain. Our contribution to the knowledge and development of nuclear power production has been anything but a " feeble fraction " and it is irritating to find such a statement given publicity in a British Government publication. We will not comment on the rest of the sentence.

POINTERS TO THE FUTURE

British achievements in various fields since 1822, the year of the foundation of the *Sunday Times*, were features of the 7,000th issue of that journal, published this week. Contributions by Viscount Chandos, Sir Lawrence Bragg and Sir Miles Thomas were much more than historic records of engineering progress, great as these were during the last 125 years. The authors implied in different ways that the past is but a gateway to the future and produced evidence that what this country has done it is more than likely to do again. An illustration of the continuance of the spirit of enterprise, so notable in its world ramifications, is to be found in the pioneering of full-scale nuclear power stations to meet vastly expanded electrical needs.

LOCAL GOVERNMENT FINANCE

The revision of the existing arrangement by which industrial establishments are rated at 25 per cent of their net annual value had been foreshadowed and last week the Government announced its intention of introducing legislation which, *inter alia*, will raise the proportion to 50 per cent. As local rates are expenses for taxation purposes, industrial concerns will not have to bear the full impact of the proposed increase. The Order governing the valuation of plant and machinery for rating purposes is to be replaced by a more up-to-date one. Methods of rating the electricity supply authorities are being revised and a point of interest is that those parts of electricity and gas showrooms used as shops are to be separately and directly assessed.

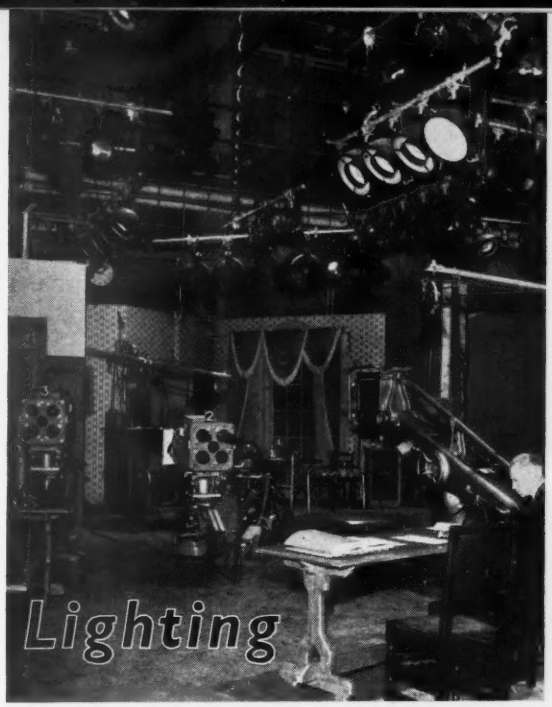
DISTRACTIVE LIGHTING ?

At the instance of the Woolwich Borough Council the Metropolitan Boroughs' Standing Joint Committee has taken up with the Government the question of the possible danger of shop-window lighting causing street accidents. The Woolwich Council has stated that it had received complaints about this and that in particular strip lighting was sometimes installed at levels which might distract the attention of motorists, the danger being especially acute at traffic signal points.

The Ministers concerned are being asked to consider legislation on the subject. While we agree that if serious consequences are arising from shop-window illumination something should be done about it, we are not inclined to welcome more legislation. Properly installed lighting, even if brilliant, should not distract motorists; it may be the contents of the windows that do it. A campaign to educate shopkeepers in the principles of good lighting might have effect and it should certainly produce lucrative business. Such a campaign might be organised jointly by the lamp and fittings makers, electrical contractors and Electricity Boards if they could get together for the purpose.

CONTROL FACILITIES AT THE B.B.C. RIVERSIDE STUDIOS

By F. P. BENTHAM, F.I.E.S.*



STUDIO space has been the most urgent need of the B.B.C. Television Service in the post-war years, and the taking over of film studios as at Lime Grove has meant the use of the electrical installation and lighting equipment common to film studios. From the point of view of co-ordinated control, film studio practice is archaic and has led to much improvisation and makeshift. Fortunately, this state of affairs was recognised and schemes were planned to make use of the best mechanical and electrical practice available to-day.

Meanwhile, American television started up as a public service seriously in 1946. As the studios were run by private enterprise, inefficiency of operation was not tolerated. Consequently there seems to have been a headlong rush for control schemes, which began with the crudest of lighting switchboards, through the American equivalent of the old Alexandra Palace controls installed in 1936, and finally to the multi-scene pre-set system. We have always disliked this last-mentioned technique for reasons stated later on, so the needs of the B.B.C. were considered independently. Early in 1955, commercial television suddenly demanded schemes to go into use within about six months, and work was concentrated on the commercial studios. By the time we returned to the B.B.C. problem there was a fund of knowledge and experience to add to any hints that the American scene could provide. The lighting control in the Riverside I studio is the result of all this experience thrashed out in many discussions with the B.B.C.

Fig. 1.—Lighting control board in the old B.B.C. television studios at Alexandra Palace (1936)

Lighting Layout

The first lighting problem posed by any television studio is that of the rigging, wiring and positioning of the multiplicity of lighting units required for every production. Each lighting layout will have to be completely different from those for the shows that precede and succeed it. To cater for this, the B.B.C. have chosen a system of short suspension bars, each operated by its own motor-driven hoist, the whole being controlled from a control desk.

Each bar contains four lighting outlets and as there are 79 bars in Riverside I, we are concerned with the control of 316 circuits. In Riverside II there are 62 bars and 248 circuits. In addition to these, there are auxiliary socket outlets round the gantry and floor. Nevertheless, most of the lighting circuits terminate in socket outlets which, although on motor-driven bars, are virtually inaccessible from the studio once the lighting is rigged. This means that when the particular units have been plugged into these outlets any changes in grouping will have to be made from some other point.

At Riverside all these lighting circuits do in fact go to the dimmer room, this being the general term for the seat of the load carrying, switching and dimming equipment. Here it becomes necessary to provide some means of selecting which of the circuits will be used for a

* Manager, Research & Development Section, Strand Electric & Engineering Co., Ltd.

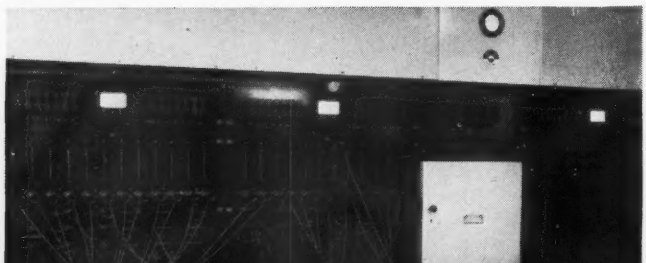


Fig. 2.—Part of the patching field with jacks in Riverside II studio

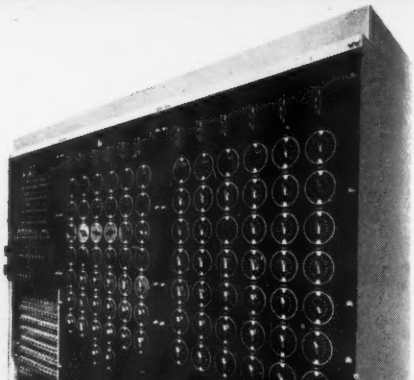


Fig. 3.—Patching by means of selector switches

particular production, as it is out of the question that these should all be remotely switched from the lighting control panel. Not only would this be uneconomic because probably only about 100 circuits are required for any one production, but the switch and dimmer control for many hundred circuits would take up much space and be confusing to operate. To select the circuits for a production and connect these to a control panel liberally, but not extravagantly, provided with control circuits, a device known as a " patching panel " is used.

Simple Patching

The simplest and commonest way of patching is to provide each circuit with an outsize telephone type jack plug and each control channel with a socket. This system has been adopted in Riverside II and Fig. 2 shows part of the jacking panel in that studio. Along the flat table are the jacks for the studio circuits and on the vertical panel the sockets for the control channels. The term " channel " has been borrowed from radio and applied to lighting, thus Riverside II can be expressed as 300 circuits and 144 control channels. Ninety-six of these channels have dimmers and 48 are " switched only." The dimmer channels have two sockets on the patching panel so that more than one lighting circuit can be controlled from a channel. Fig. 2 shows roughly half of the patching installation for Riverside II and illustrates some of the reasons for discontent with the system. The first is that obviously all this large current-carrying equipment must be remote from the operations centre; consequently modification of the production layout is not convenient. The second is that as a large set-up is patched so the crossing cords tend to lead to confusion and it is very difficult to identify which circuit is on which channel unless very complicated schedules are kept. The third objection is that with 300 circuits we are considering a relatively small installation and studios involving more than 1,000 circuits (already there are a few such in the United States) may be expected and the jack field will become proportionately larger and more complicated.

Essentially, a jack field assumes that any circuit may be required in any control channel and the Riverside board, whose cords cannot be long enough always to do this directly, has built-in jumper sockets and jacks to assist. However, there is a school of thought which considers a little more discipline and restriction of choice could improve the apparatus and perhaps be salutary for the lighting supervisor, the question being whether he should sacrifice some of his freedom of choice of control channel and gain a more compact and memorable system.

In each of the Associated Rediffusion studios at Wembley a selector switch is used for each circuit. Each switch has 15 positions to patch to 14 dimmers or to " live," all circuits being subject to over-riding contactor control. The panel in Fig. 3 is for a relatively small studio of 88 circuits with 28 transformer dimmers. As each circuit is on a selector switch, elaborate precautions have to be taken to prevent many circuits being set on to one particular dimmer. The advantage at Wembley is that the selector switch arrangement is made by auxiliary circuitry to indicate on the control desk the patch set-up. Thus, to find out what one is controlling it is not necessary to consult the patching panel at all.

This was thought to be an advantage and in fact some such system was considered for Riverside I. However, it was impracticable to have 400 load-carrying selector switches, and the question of patching by relays arose. The difficulty was to keep the number of relays within bounds and also to cover the overload risk. The latter problem is almost insoluble because a dimmer may be in circuit and be limiting the current. It was thus inadvisable to consider connection of more than one circuit per channel. Once it is established that each control channel should only control one lighting circuit, an arrangement whereby the selector switch belongs to the lighting control channel and not to the circuit becomes obvious. Such an arrangement immediately reduces the number of selector switches or relays, although the number of control channels will have to be increased a little since in no case can we economise by controlling two circuits.

Riverside I is the result of this line of thought. Each control channel has seven relays which connect it to seven circuits. The remote control panel, which is shown in Fig. 4, is very compact, being 5ft high and less than 3ft wide. Using this panel the circuits in the studio can be patched to roughly half the number of control channels. To avoid a further stage of patching to choose " switched only " or " dimmer," all these control channels are provided with dimmers.

To illustrate precisely the nature of this patching selection let us consider one area of 14 circuits. This would be provided with eight dimmer channels each represented by a miniature eight-position selector switch. The eighth or bottom position is " off," i.e. no circuits

patched, and each of the other seven positions connects one lighting circuit. Each selector switch has a choice of circuits which differs by two circuits from its neighbours on either side. For example, the left-hand switch can choose circuits 1-7, the next switch chooses 2-8, and the one next to that 3-9, and the whole series is continued 4-10, 5-11, 6-12, 7-13 and 8-14. Thus, for circuit 1 we must go to one particular control channel that is represented by the lever on the left and the same limitation applies to circuit 14 on the right. On the other hand, circuit 2 has two choices, provided, of course, that circuit 1 is not required. Circuit 2 could be on channel 1 or 2, and other circuits working to the centre become progressively more fortunate; for example, the two centre circuits 7 and 8 both have seven alternative channels.

Fig. 5 shows a close-up of this arrangement. Of course, although only one circuit can be patched to a particular dimmer channel, several dimmer channels can be patched to one circuit. Without mechanical interlocking of relays this system can be applied safely only to resistance dimmers, but there is no particular objection to this, particularly for television work, as the heat losses in the dimming range common to television, i.e. between full light and half light, will never amount to more than 17 per cent of the nominal watts of the lamps. Furthermore, as there is only one circuit to each dimmer it is not called upon to provide a variable load factor better than between 2 kW and 500 W.

So far, the reduction of the large number of lighting circuits to a reasonable number of channels (166) has been discussed, and the requirements of production control which have led to the instrument actually installed in Riverside I must now be examined.

The objects of a lighting control system for a television studio are as follows:—

(*a*) To carry out the production lighting requirements easily and quickly, thus facilitating good pictures. This includes the theatre type of change, i.e. lighting for dawn, sunset or moonlight or for dramatic effect.

(*b*) Provide group switching from one scenery set to another scenery set to reduce heat build-up and current demand in a studio.

(*c*) By co-ordination of the lighting into one control close to the centre of production to minimise confusion and save time at rehearsals. To achieve these objects we need:—

(*d*) A compact control desk such that a single operator seated in front of TV monitors can reach every control.

(*e*) Immediate ability to switch any circuit.

(*f*) Quick selection of circuits in variable groups to be followed immediately by other groups replacing or supplementing the group in use.

(*g*) Facilities for dimming for balance of lighting and, to a lesser extent, for theatre type lighting changes.

(*h*) Facilities for quick correction of lighting necessitated by change of circumstances at rehearsal and when on the air.

Memory System of Control

At Riverside I, an instrumental rather than switchboard approach has been made to the lighting control. This is shown in Fig. 6, from which it will be seen that the lighting operator is in close touch with the camera control unit operators whose monitors appear directly in front of his desk. The 166 lighting channels will seldom be used singly but rather as a series of large or small groups depending on the type of production, number of scenes, their location and so on. This leads to the need to enable an operator to set up his groupings as readily as possible and subsequently to recall them by pressing a single button at a time. This has been the aim at Riverside I, and a particular feature is the so-called memory system which enables 20 groups of control channels to be memorised and captured on 20 push-buttons.

The system is based on an engraved luminous organ type push for each control channel. When any push is touched it is illuminated internally and lights the lamp which has been selected in the studio. If there are 20 lamps, the particular group of 20 channel pushes required can be captured on to what may be termed pre-set or memory No. 1 button. This is done by pressing the master setter and the particular push on which it is required to memorise that combination. Thereafter, it is only necessary to press pre-set No. 1 and that particular combination will light up on the luminous pushes of the switchboard and also in the studio. Other buttons will remove this combination and substitute their own. As this action only affects the pilot lamp inside the switch-head, group switching, no matter how many channels are involved, is absolutely silent at the desk.

The normal television type lighting change procedure can be expected to need addition of the contents of two pre-sets. Thus, if pre-set 1 has the lighting for scene 1 and pre-set 2 has the lighting for scene 2, there is likely to be a time when the producer will require preview from a camera directed at scene 2 before this camera is actually switched over to transmission. Consequently, this switchboard provides that if pre-set 2 is pressed while the foot is on a master " add " button the two combinations of lighting are added. Subse-

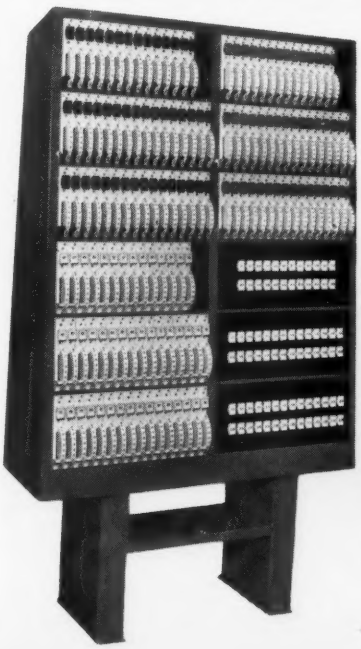
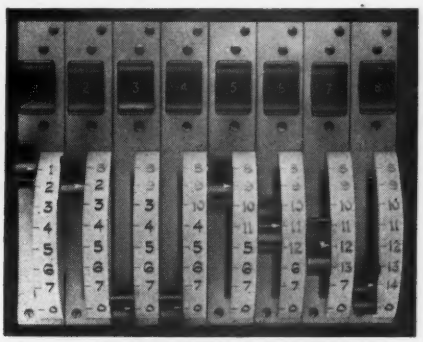


Fig. 4.—The remote patching panel installed in Riverside I studio

Fig. 5.—Close-up of remote patching panel



quently, when scene 2 is on transmission, pre-set 2 will be pressed on its own and scene 1 "killed." This ability to add pre-sets is extremely valuable, because without it extra buttons would be required to set the additive combination and thus, to get from pre-set 1 to pre-set 2, an intermediate button would be needed.

Provision is also made on the switchboard for the actual lighting in the studio to be locked and the switchboard switching lines uncoupled. Thus, the combination on a pre-set may be checked and perhaps modified before it is actually switched to the studio lights. Furthermore, a change for which there is plenty of time to prepare need not use a pre-set button. The studio can be locked to the last lighting combination and the new combination prepared by hand.

Dimming Control

So far, nothing has been said about dimmers and it is these which give television and stage lighting controls their unique character. A dimmer is designed to give stepless regulation in light intensity from nothing to full-up, and of the various forms used, the resistance or auto-transformer have already been referred to. In addition there is available the saturable reactor, the more elaborate magnetic amplifier, or the "all-electronic" thyratron equipment.

Leaving aside points of electrical detail, the main difference between these types of dimmers as it affects the pre-set argument is that whereas the first two require some sort of mechanical drive, the last three are wholly electrical in their control. At first sight the latter with the absence of moving parts would appear to offer the best prospect for compact control. After all, what can be easier than the quick control provided by a thyratron valve.

Unfortunately, apart from the poor electrical efficiency of thyratrons, there are other drawbacks. One of these they share with the saturable reactor and magnetic amplifier, that, being all electrical, they require to be continuously energised to hold the lighting state. For example, if three lamps are at intensities of 50, 75 and 100 per cent, the grid control or saturating coil control levers must remain at those positions. On the other hand, an electro-mechanically driven set of resistance or transformer dimmers once driven to a particular level can be uncoupled from the controlling switchboard and will hold their levels while the switchboard levers are reset to the next levels; only when recoupled will the latter take effect. This factor outweighs all other considerations.

Each lighting control channel is provided with a dimmer, and under each channel switch there is a pair of dimmer levers (Fig. 7) representing two alternative controls for that dimmer. These levers work through a servo-mechanism to the remote dimmer downstairs. The servo-mechanism is simple in that the control lever constitutes the centre point of a potentiometer and a single line passes downstairs to the coil of a polarised relay and thence to a similar potentiometer operated by the dimmer itself. There is nothing new in this but previous driving systems employing this method have failed because the dimmer was operated by its own individual reversing motor. Such an arrangement leads to hunting and also does not lend itself to a wide range of variable speed. In the Riverside I installation a modernised version of the electro-magnetic clutch drive used by Strand Electric since 1930 is employed. Thus, when the bridge circuit is put out of balance one way, the polarised relay engages the necessary clutch to drive the dimmer to the balanced position. The speed at which it arrives at this position is governed by the speed at which a driving shaft, common to all dimmers, is operated by its unidirectional motor. Reversal of the dimmer is obtained by using a pair of clutches of which the polarised relay has to select the appropriate one.

Master Dial Dimming

Here is a means of determining the extent, direction and speed of dimmer movement. While the dimmer is moving from one position to another very slowly, or when a lever has been moved while the dimmer is unlocked from its control levers, we can no longer use the dimmer lever to judge the position of the dimmer. An alternative indication in the shape of a master dial, which can be connected to any dimmer potentiometer and which is calibrated to read in the same terms as the dimmer control lever, is therefore provided.

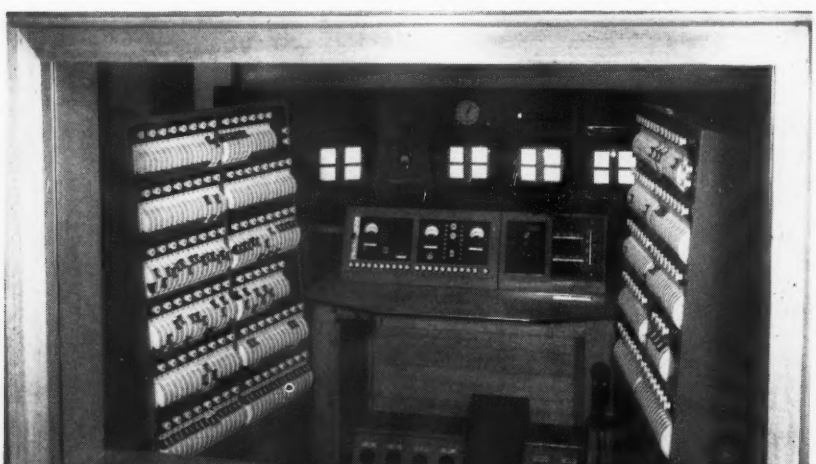


Fig. 6.—Main lighting control position in Riverside I studio

As already stated, each dimmer channel has two control levers, a black and a red, so if one set of intensities is pre-set on the black levers and another on the red, a change from one balance of lighting to another at any speed set up on the shaft motor is possible. Thus, the black dial might have a level of intensity for night effect and the red dial for a day effect and this change in lighting balance could take place in view of the camera.

So far, we have provided in the controls described 20 variable groupings for switching, obtained by pushing single buttons, and two changes of dimmer level by means of two levers for each dimmer. Obviously, without any further addition we have

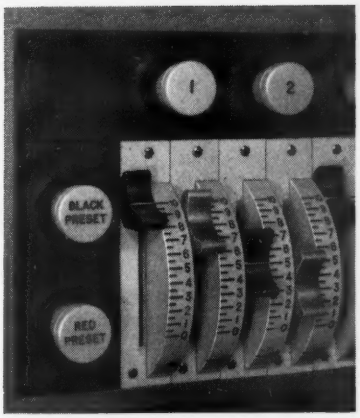


Fig. 7.—Luminous push switches in conjunction with miniature levers for pre-set dimmer control

gone a long way in lighting control, but when we examine practice elsewhere and likely practice here, and the technique is mastered, we will find that what has been so far described is quite inadequate. There must be a way of giving more pre-set dimmer changes.

It is the need for more dimmer changes that has led to what is known as the multi-pre-set board. This is now quite common in American television studios, and more and more pre-sets are being demanded. For example, whereas five was considered good five years ago and ten two years ago, 20 pre-sets are now specified. Now, five, ten or twenty pre-sets in these systems mean that the control panel has to carry that number of repeat dimmer levers for each dimmer. By way of example, ten pre-sets on an installation with 100 dimmers will require 1,000 levers to work the dimmers only. As the switchboard must be made compact, these levers become intolerably small. Their smallness tends to make them awkward to work and difficult to assess visually. Sometimes one set of larger dimmer levers is provided and the ten miniature ones become auxiliary wing pieces to the control. This arrangement makes the working of the dimmers initially more convenient, but eventually the results on the large levers have to be set up on the miniature levers and this takes a great deal of time. It is troublesome enough when there are ten sets of levers, i.e. sufficient to hold all the demands or the major demands for lighting changes for a particular production, but experience seems to show that this is not enough. It is also probable that as the number of dimmers increases, then even more pre-sets will be needed to cover the presetting time.

Assessment of Scene

When considering the design of the control equipment for Riverside, in view of experience in the United States, we decided not to pursue the multi-pre-set solution. What was needed was an assessment of the situation to see what really was happening. Let us consider three scenes in a studio each of which is likely to be used in any order. Working on dimmer levers which must retain control of the lighting, and using the orthodox pre-set system, we find that to give but one change of lighting in each of these three areas requires six duplicate dimmer levers to each dimmer. The reason for this is that a lever has still to be set for a circuit where there is no change or where there is no light. Each dimmer must be held at the same condition. This crude example shows what has been brought about by the magnetic amplifier or electronic dimmers used in the United States. This is because such dimmers need to be energised to whatever state they are required to hold, whether full on, intermediate or out. Thus, for scene 1 only, the pre-set 1 levers for that scene will be at various "on" levels and the rest "off." For pre-view scene 2 the levers in pre-set 2 will have to repeat pre-set 1 in respect of scene 1, but with the addition of the new scene 2 levels. Thence to pre-set 3 with scene 2 levels only and so forth. Six pre-sets to give simple lap changes from area to area.

In contrast, the electro-mechanical system at Riverside provides that dimmers will always stay at whatever position they were last driven to and consequently it was possible to arrange that the circuit from the light switch should also feed the dimmer clutch drive. Thus, dimmers are only operative if their lights are switched on at the control panel.

Once this idea is accepted, the whole technique of control designed for television becomes different. What we need to do is merely to pre-set the dimmers that must change on a particular lighting effect; dimmers which remain static can be completely ignored. Because there are 20 possible groupings (memory pre-sets) in regard to switching at Riverside and two dimmer pre-sets to each channel, we can store two dimmer changes for each of 20 areas of the studio and do this by means of only two dimmer levers to each channel. As there are only two dimmer levers they can be of reasonable size. This is an original approach to lighting control and one which is likely to give an extended lease of life to the electro-mechanical type of dimmer bank. It is also possible to drive all the dimmers to the levels required for their first entry and then set the red and black pre-set levers to store two subsequent changes in respect of each area.

How Many Dimmers?

As the light switch is, so to speak, the dimmer switch, it is possible to ignore the dimmer levers for movements of dimmers to "full on" or to "blackout" and two controls are fitted to provide a "raise" or "lower" in respect of any circuits which are on. This gives further respite from the task of setting dimmer levers, and is done by throwing the whole dimmer network out of balance by removing one pole or the other.

All the dimmer controls are on the two wing pieces, and in this model 264 channels could have been accommodated, but in this case the number is 166. The wings are identical in size to the patching wing referred to earlier, the working area of each being 3ft 6in high by 3ft wide.

It may not always be convenient for dimmers to be restricted to movement on those circuits whose switches are "on" at control and in the studio. For some reason we may require to move a group of dimmers within a larger switched-on group of lights. This can be done by putting down the "hold switch" which locks the lighting in the studio, but not the dimmers, independently of the channel switches.

The question of the number of dimmers required for a television studio is a vexed one as it is almost certain that the number of lights dimmed will be few compared with the number full on. However, each channel should be equipped with a dimmer because one can never tell quite which circuit one may require to dim, and repatching for this purpose can be very time consuming. There is also the question of gradual transition of lighting from one area of the studio to another. This requires dimmers as it is kinder to equipment, lamps and artists than direct switching. There can be no universal rules for television studio lighting as at present development is far too rapid, but one can safely say that the influence of Riverside I on future development in this direction will be considerable.

Professional Qualification

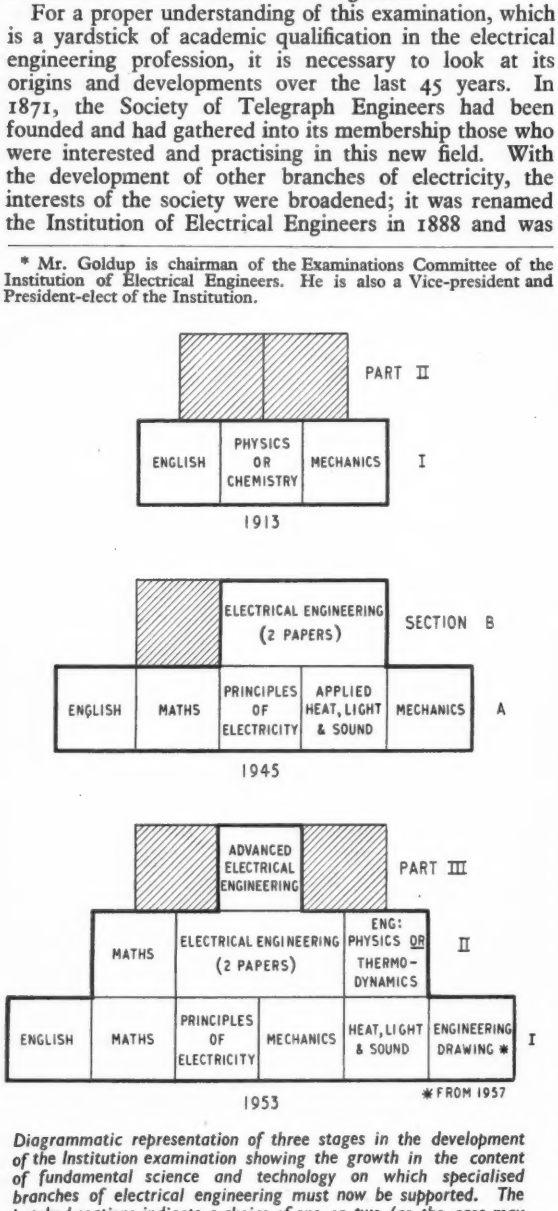
Entry to the I.E.E. through the National Certificate Scheme

By T. E. GOLDUP, C.B.E.*

To the young man who does not go to a university to read electrical engineering, the Institution examination, which must be passed or from which exemption must be obtained, is the objective of his studies at the technical college if he wishes to obtain a professional qualification and become a chartered electrical engineer.

For a proper understanding of this examination, which is a yardstick of academic qualification in the electrical engineering profession, it is necessary to look at its origins and developments over the last 45 years. In 1871, the Society of Telegraph Engineers had been founded and had gathered into its membership those who were interested and practising in this new field. With the development of other branches of electricity, the interests of the society were broadened; it was renamed the Institution of Electrical Engineers in 1888 and was incorporated by Royal Charter in 1921. Until 1912 no rigid academic test had been applied to those who sought membership, but in this year the Council decided to institute an examination designed principally to test the academic knowledge of those who had grown up in the practice of electrical engineering. It was, therefore, an examination for the more mature candidate.

* Mr. Goldup is chairman of the Examinations Committee of the Institution of Electrical Engineers. He is also a Vice-president and President-elect of the Institution.



Diagrammatic representation of three stages in the development of the Institution examination showing the growth in the content of fundamental science and technology on which specialised branches of electrical engineering must now be supported. The hatched sections indicate a choice of one or two (as the case may be) from about eight electrical engineering subjects related to special applications

Range of Subjects

The first examination held in 1913 was in two parts, the first of which contained papers in English language (or translation from certain foreign languages), physics (or inorganic chemistry) and applied mechanics. The second part tested the knowledge of the candidate in two branches of electrical engineering selected from eight subjects, namely, electricity supply, electric lighting and power, electric traction, telegraphy, telephony, application of electricity to mines, electro-chemistry and electro-metallurgy, manufacture of electric machinery (including works management) or design of electric machinery and apparatus. As the science of electrical engineering developed, modifications to the examination were introduced and in 1931 electrical technology became a separate subject in the first part of the examination, the whole of which was reconstructed in 1945, marking the first of two important stages in bringing the examination to its present form.

Further, the character of the examination changed from one originally designed to test the knowledge of those who for some time had been practising in electrical engineering, and were therefore the older and more mature candidates, to one requiring, by way of preparation, the following of appropriate courses of study and against which exempting qualifications could be judged. The syllabuses of the various subjects also became the basis on which professional courses were developed in the technical colleges.

The examination of 1945 was still in two parts, the first known as Section A consisted of papers in English language, mathematics (for the first time), principles of electricity, applied mechanics, and applied heat (with light and sound). Section B consisted of two papers in electrical engineering, and a third in one special subject chosen from a selection of eight alternatives. This examination indicated the pattern and standard of the academic qualification of the professional electrical engineer in the immediate post-war period.

The development of electrical engineering science and practice progressed at a phenomenal rate and the academic attainments needed by the successful electrical engineer had also progressed rapidly beyond that of the immediate post-war period. This was reflected in the development of syllabus content and examination standards of university degrees in electrical engineering and the Council of the Institution were at the same time planning corresponding changes in the Institution examination. They were unwilling, however, to effect this by the introduction of additional requirements in the existing syllabuses and undertook a complete revision of the examination designed to create a basic structure which

would remain unaltered over a number of years, despite the development of ever-widening fields of application, and at the same time to cater for a degree of specialisation in certain fields which was becoming increasingly evident in the practice of individual electrical engineers. The new form of the examination was promulgated in the examination regulations published in September, 1953, which became fully operative this year.

Present Examination

The Institution examination is now in three parts: the first part, conducted by the Engineering Institutions' Examination, Part I, Committee, is common to the Institutions of Civil, Mechanical, Electrical, Municipal, Marine and Gas Engineers; the second and third parts apply to the Institution of Electrical Engineers. Part I consists of the subjects of English, mathematics, applied mechanics, principles of electricity, heat, light and sound, and engineering drawing, all fundamental subjects, and forming the basic scientific material which is necessary for all professional engineers. In Part II of the examination there is a paper in more advanced mathematics, one in either engineering physics or in thermodynamics and two of a general character in electrical engineering. In Part III advanced electrical engineering as a fundamental subject is included with one paper applicable to all electrical engineers, in addition to which there are two special subject papers (which remain at the standard of the former Section B) selected from eight alternatives, namely, electrical machines, electrical measurements, electricity supply, electronic engineering, illumination engineering, line communication, radio communication, and utilisation of electrical plant. Thus, the changes from the 1945 examination are the inclusion of engineering drawing in Part I and the restriction of heat, light and sound to fundamentals rather than the application of heat engines, the extension of mathematics and engineering physics or thermodynamics into Part II, and a more advanced study of the fundamentals of electrical engineering as a subject common to all candidates in Part III. The hard core or unchanging structure of the examination is Parts I and II and advanced electrical engineering of Part III, on which the rapidly developing special subjects can be superimposed now, or at any future date. The growth of these basic requirements is illustrated in the diagram.

Table I.—Changes in Exemption from the Institution Examination through the National Certificate Scheme

Before 1957 (1945 Regulations)	After 1957 (1953 Regulations)
Exemption from Sections A and B (i.e., Complete exemption)	**Exemption from Parts I and II**
FOR APPROVED COURSES	**FOR APPROVED COURSES**
1. O.N.C. with credit in two electrical subjects.	1. O.N.C. with credit in two electrical subjects.
2. H.N.C. with credit in two electrical subjects.	2. H.N.C. with credit in two electrical subjects.
and	*and*
3. Endorsement certificate* in: Mathematics (A.2) Applied Mechanics Applied Heat Light and Sound	3. Endorsement certificate* in: Mathematics (A.2) Applied Mechanics Physics (Heat, Light and Sound) Engineering Physics or Thermodynamics
and	*and*
4. School Certificate with English Language credit	4. G.C.E., English Language at "O" level
or	*or*
G.C.E. English Language at "O" level	Scottish Leaving Certificate, English (Higher Grade)
or	*or*
Scottish Leaving Certificate, English (Higher Grade)	Engineering Institutions' Part I Examination, English. (This will not be held after 1960.)
or	
Joint Section A English.	**PART III**
	To complete educational requirements it is necessary to attend an approved course and pass Part III of the Institution examination in: Advanced Electrical Engineering Two Special Subjects out of eight listed in the Examination regulations

* An endorsement certificate is not required where a pass with credit in the subject has been obtained in an assessed examination for the Higher National Certificate.

Table II.—Sandwich Courses approved by the Institutions at 1st July, 1957
(These courses normally occupy 4–5 years)

Recognition	College	Award
I. Complete Exemption	Acton Technical College	Dip. Tech. (Eng.)
	Birmingham College of Technology	Dip. Tech. (Eng.)
	Brighton Technical College	Brighton T.C. Diploma in Elec. Eng.
	Glasgow Royal Technical College	Associateship
	LONDON:	
	Battersea Polytechnic	Dip. Tech. (Eng.)
	Borough Polytechnic	Dip. Tech. (Eng.)
	Northampton College of Advanced Technology	Diploma of the Northampton Engineering College
	Woolwich Polytechnic	Dip. Tech. (Eng.)
	Rugby College of Technology	—
II. Exemption from Parts I and II and acceptable as an approved course for Part III	Bristol College of Technology	Higher National Diploma
	Glamorgan Technical College	Higher National Diploma
	Huddersfield Technical College	Higher National Diploma
	Kingston Technical College	Higher National Diploma
	Leeds College of Technology	Higher National Diploma
	Medway College of Technology	College Diploma in Electrical Engineering
	Portsmouth College of Technology	Diploma of the Portsmouth College of Technology
	Rotherham College of Technology	Higher National Diploma
	Salford — Royal Technical College	Higher National Diploma
	Stafford County Technical College	Higher National Diploma

III. Other courses are available which have been approved as covering only part of the Institution Examination.

Exemption from the Examination

Only a small number of candidates qualify for admission to the Institution by taking the whole of the Institution examination. The great majority obtain exemption by virtue of some other academic qualification. A schedule of accepted educational qualifications is published by the Council of the Institution, and these include degrees in engineering of universities in the United Kingdom and abroad, where electrical engineering is dominant in the final examination; approved Diplomas in Technology (Engineering) granted by the National Council for Technological Awards; the associateships and diplomas of certain colleges of technology; and in some cases the Higher National Diploma, although in general this will only qualify for partial exemption. Reference to the particular college or to the schedule is necessary in such cases.

The most complicated exemption problem is the one relating to Ordinary and Higher National Certificates and Endorsement Certificates in this scheme. Where the individual course is approved for exemption purposes, the candidate must have obtained the Ordinary National Certificate with credits in two electrical subjects, and the Higher National Certificate with credits in two electrical subjects, after which exemption is granted from Parts I and II of the Institution examination on a subject-for-subject basis. Given this condition, the Ordinary National Certificate and the Higher National Certificate grant exemption from principles of electricity and engineering drawing of Part I and from electrical engineering of Part II, after which credit standard must have been

obtained either in the final examination for the Higher National Certificate or as an endorsement subject, in applied mechanics, heat, light and sound, mathematics (at A.2 level) and engineering physics or thermodynamics, this combination gaining exemption from the technical subjects of Parts I and II. Exemption from the English of Part I may be granted to holders of the General Certificate of Education in the English language at ordinary level and certain other qualifications in English, of equivalent or higher standard, including the Scottish Leaving Certificate with English, at the higher grade.

Having obtained exemption from Parts I and II, a National Certificate candidate who wishes to proceed to the professional qualification must attend an approved course in preparation for advanced electrical engineering, and two of the eight alternative special subjects, and enter for Part III of the Institution examination. No exemption from Part III is granted by virtue of National Certificates or endorsement subjects.

It is a general requirement that a candidate must have passed or obtained exemption from the whole of the technical subjects of Parts I and II before being admitted to Part III, but an exception is made in the case of the subject of engineering physics (or thermodynamics) which may be taken concurrently with Part III, in which advanced electrical engineering, either alone or with one or two special subjects, may be taken at one examination. It is not permissible, however, to sit for the special subjects without advanced electrical engineering, unless this has already been passed.

Although the revised examination regulations were intended to come into force completely in 1956, the Council of the Institution have granted a special extension of one year to National Certificate candidates to qualify under the old regulations because of the arduous conditions under which they are qualifying, and to prevent undue hardship. Such candidates may obtain complete exemption under the old regulations if, by the end of the session 1956-57, they have attended an approved course and obtained the Ordinary National Certificate with credits in two electrical subjects, the Higher National Certificate with credits in two electrical subjects, and passed at credit standard in mathematics A.2, applied mechanics, and heat, light and sound. A failure in any one of these conditions renders the candidate liable to satisfy completely the requirements under the new regulations. The changes in exemption requirements are shown in Table I.

There is a frequent misunderstanding regarding the position of the Part III examination in relation to the Higher National Certificate. The Higher National Certificate course should go into the Part III syllabus of advanced electrical engineering and a certain amount of some of the special subjects of Part III are also frequently covered in the Higher National Certificate scheme. In these circumstances it is usually necessary for the candidate to study for one-and-a-half evenings per week for a year in respect of each subject in order to prepare adequately for the Part III examination or an equivalent period in the day release courses. A satisfactory course can be arranged for two terms of full-time study including either engineering physics or thermodynamics of Part II, the three subjects of Part III and some non-technical subjects which give breadth to the course, and this is available at some technical colleges. Such courses have to be approved by the Institution as satisfactory preparation for entry to the examination.

Table III.—Approved Courses in preparation for Part III of the Institution Examination, at 1st July, 1957

College	Length
FULL-TIME COURSES	
Birmingham College of Technology	6 months
Liverpool—Automatic Telephone & Electrical Co., Ltd., School of Electronics.	1 year
LONDON:	
Borough Polytechnic	6 months
Northampton College of Advanced Technology	6 months
Plymouth and Devonport Technical College	9 months
Portsmouth College of Technology	6 months
PART-TIME DAY COURSES (These courses normally occupy a minimum of two years)	
Birmingham College of Technology	
Bournemouth Municipal College	
Bradford Technical College	
Brighton Technical College	
Chelmsford—Mid-Essex Technical College	
Dagenham—S.E. Essex Technical College	
Farnborough—R.A.E. Technical College	
Leeds College of Technology	
LONDON:	
Borough Polytechnic	
Lewisham, S.E. London Technical College	
Northampton College of Advanced Technology	
Manchester College of Science and Technology	
Preston—The Harris Institute	
Salford—Royal Technical College	
Southall Technical College	
Southampton—The University	
Swansea Technical College	
West Ham College of Technology	
Wimbledon Technical College	
Wrexham—Denbighshire Technical College	
PART-TIME EVENING COURSES (These courses normally occupy a minimum of two years)	
Bournemouth Municipal College	
Bradford Technical College	
Brighton Technical College	
Burnley Municipal College	
Chelmsford—Mid-Essex Technical College	
Coventry Technical College	
Dagenham—S.E. Essex Technical College	
Gloucester Technical College	
Huddersfield Technical College	
Leeds College of Technology	
LONDON:	
Borough Polytechnic	
Lewisham, S.E. London Technical College	
Northampton College of Advanced Technology	
Polytechnic, Regent Street	
Manchester College of Science & Technology	
Southall Technical College	
Southampton—The University	
Southend Municipal College	
Swansea Technical College	
West Ham College of Technology	
Wolverhampton and Staffordshire College of Technology	
Wrexham—Denbighshire Technical College	
SCOTLAND:	
Edinburgh—Heriot-Watt College	
Glasgow—Royal Technical College	

"Sandwich" Courses

The part-time route for qualification has become excessively arduous and an increasing number of students are being allowed to attend "sandwich" courses consisting of six months in industry and six months in the technical college over a period of four to five years. The students for such courses should be "industry-based," that is, they should have a formal engagement as student apprentices before enrolment by the college, since this places the obligation for a full and integrated practical training upon the employer who is in a position to see that it is provided in a way which is impossible with students who are "farmed out" to industry by the college. This type of course should be regarded as a preferred alternative for student apprentices. Some of such courses are approved for complete exemption from the Institution examination whilst success in others gains exemption from Parts I and II, and may provide that the students will be admitted to the Part III examination without attending a further course in preparation.

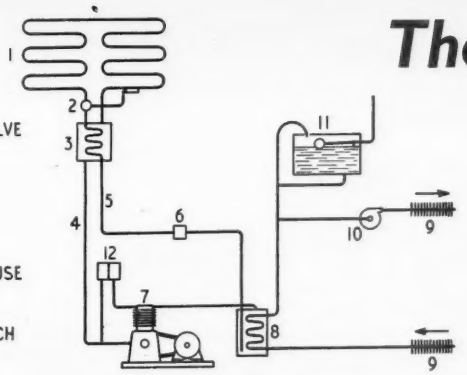
A summary of sandwich courses which have so far been considered by the Institution with their exemption is given in Table II, and courses which have been approved as preparation on a part-time basis for the Part III examination are given in Table III. Not all of these courses will be operating during 1957-58 and inquiries should be made at the colleges concerned.

The Heat Pump

An Interesting Domestic Installation

By A. J. SIMPSON

Schematic arrangement of heat pump system



THE idea of using a refrigerating machine as a heat pump to heat homes and buildings in the colder weather was first advanced by Lord Kelvin more than 90 years ago. The principle on which the system operates is that heat is absorbed in an evaporator from any available low grade heat source such as the ambient air, the ground, or perhaps best of all a natural water source. This heat is pumped to a higher temperature and delivered to a condenser where it is transferred to air ducts or suitably designed water pipes and used for space or other heating purposes.

The heat pump is sometimes called the reversed heat cycle and it is an efficient means of utilising fuel and power. The coefficient of performance (c.o.p.) attributed to a reversed Carnot cycle is always greater than unity. The c.o.p. equation is:—

$$\frac{\text{Heat discharged to the condenser}}{\text{Mechanical energy required to operate compressor}}$$

or $\frac{T_1}{T_1 - T_2}$. Here T_1 is the absolute condensing temperature, and T_2 is the absolute evaporating temperature. Theoretically, seven to eight times as much heat can be obtained as the work put in. The smaller the difference between the condensing temperature T_1 and the evaporating temperature T_2 the greater the c.o.p. becomes. This is well illustrated by an example in which we will assume the condenser temperature to be 125 deg F, and the evaporator temperature 50 deg F. Adding 459 deg to each of these figures to convert them to absolute temperature the c.o.p. becomes $\frac{584}{584-509} = 7{\cdot}78$ approx.

A second example shows that the greater the difference between condensing and evaporating temperatures the lower the coefficient of performance.

If the condenser temperature is 135 deg F, and the evaporator temperature is 30 deg F, then the c.o.p. is

$$\frac{594}{594-489} = 5{\cdot}66.$$

In practice the actual c.o.p. is found to be about 60 per cent of the ideal, thus in the above examples we have outputs of 4·668 and 3·396 times the heat energy inputs respectively. In electrical terms this means that for every kW of input to the driving motor over 4·6 kW of heat output can be obtained in the first example and 3·39 kW in the second. In both cases the heat pump is assumed to be operating at 60 per cent overall efficiency.

The writer has installed an experimental heat pump for space heating his bungalow with a view to effecting maximum fuel economy consistent with comfort conditions of a higher order than is usual in small domestic households. A number of design factors affecting the average private householder have been considered and the heat pump system has been installed with:—

(a) The minimum of structural alteration to the existing bungalow.

(b) The utilisation of the existing single-phase electricity supply.

(c) Virtually no sound transmission into the rooms.

(d) Lowest possible operating costs.

Essentially, the plant consists of a twin cylinder compressor unit driven by a 1½ h.p. 230 V single-phase repulsion induction motor, a 350ft by 1in nominal bore steel pipe direct expansion evaporator, and a shell and coil type water/refrigerant condenser. The heating is effected by water circulating through some 80ft total of extended surface gilled tubing installed along the skirting boards in each room.

The bungalow has a floor area of about 1,100 sq ft, is detached and has a flat, hollow concrete block roof to which additional heat insulation has been added by the writer. Heat is delivered to the interior at the rate of about 15,300 B.Th.U/hr and is distributed according to predetermined design requirements, i.e. the temperature in the bedrooms is some 10 deg F lower than in the lounge. The hall is 5 deg lower than the lounge. The kitchen, which receives supplementary heat from a cooking appliance, burning of waste, etc., receives the least heat from the heat pump. The bathroom receives background heating only from the heat pump and requires supplementary heat from an electrical radiant heater during bathing. This distribution of heat achieves the greatest economy and enables a generally warm condition to be maintained throughout the house during winter with comfort conditions in the lounge for sitting occupants. An electric imitation log fire provides the psychological effect.

The heat pump has a rating of 1·4 kW and the water-circulating pump requires a further 0·3 kW. The heat input to the house is equivalent to 4·5 kW automatically controlled to temperature requirements. It is considered that larger applications for the heat pump would be both practical and economical to an even greater degree than this.

Principle of Operation

Low grade heat is absorbed from the ground by the evaporating refrigerant, liquid sulphur dioxide. This ground heat provides the latent heat of vaporisation for the liquid. The resulting heat laden vapour is pumped by the compressor to a higher temperature and pressure into the shell of the shell and coil condenser. Water which circulates through the house heating pipes is pumped through the coil of this condenser where heat is transferred from the hot high-pressure gas, causing the

gas to liquefy. The SO_2 liquid then returns to the evaporator via a thermostatic expansion valve whence the cycle recommences.

Extensive winter tests carried out by the writer indicate that with the evaporator coil buried in the ground at an average depth of 3ft 6in the effect of low wintry air temperatures does not materially affect the evaporator temperature. The ground temperature adjacent to the evaporator over a period of five months (September to February) and following the initial pull down has stabilised at about 25 to 27 deg F resulting in an SO_2 evaporating temperature of 20 deg F. The ground at 3ft 6in below surface, is mainly sandstone into which the evaporator single pipe grid is embedded. The condenser gas temperature is 135 deg F, which produces an outgoing water temperature for heating of about 125 deg F, and this is continuously maintained during the unit running cycle.

The extended surface gilled house heating circuits are designed to dissipate all the heat from the heat pump when a 60 deg F temperature difference exists between the room temperature and the circulating water.

Alternative Methods

Many variations of low grade heat and output heating are possible to suit individual conditions (see table).

If an air duct system is used for space heating a better c.o.p. can be obtained. This system can also be reversed in summer to provide comfort cooling. If water is used for space heating, use can be made of floor or ceiling radiant heat panel systems (preferably ceiling panels). However, both these systems involve extensive structural alteration to existing houses and premises.

Low Grade Heat Source	Heating Output Medium
Ground	Air
Ground	Water
Air	Air
Air	Water
Water (city mains)	Air
Water (well)	Air
Water (river)	Air } or water
Water or coolants from machines	Air

For a nation whose economy depends to a large extent upon fuel and power, utilisation of otherwise waste heat would seem highly desirable. One observes heat dissipated from machinery and plant of every conceivable type being transferred to waste by the medium of air, water or other coolants, while at the same time stokers are busy feeding fuel into boilers for space and water heating applications. Many millions of gallons of mains water is wasted each year for cooling purposes which could be both cooled, recirculated and converted to useful heating by means of the heat pump.

An Electric Traction Pioneer

THE centenary of the birth of Frank Julian Sprague, which occurs on 25th July, is an occasion for paying tribute to a forgotten genius who has been chiefly noted in history as "Edison's assistant" rather than pioneer in electric traction systems. Descended from a Dorset family which emigrated in 1628, young Sprague himself had the normal American type of training at the United States Naval Academy, an education for which he had to borrow $400 to eke out an existence.

He took to physics and chemistry and soon found electrical science was to be his *métier*, beginning his experimenting on the "inverted" type of dynamos soon after leaving the Academy. We hear of him fitting out one ship with an electric call-bell system, and later at the age of 25 as the only American member of an awards committee at the Crystal Palace Exhibition of 1882. The awards were for lamps, dynamos and other equipment, the committee having Lord Kelvin as president. Sprague had another link with this country when he described before the British Association Edison's method of constant potential distribution as distinct from constant current.

Sprague's schemes and ideas for motors and lighting systems, based on Edison's work, attracted the attention of E. H. Johnson, one of Edison's staff, and the young inventor was urged to join Edison himself. Yet Sprague was aiming at electrical power systems rather than lighting schemes sponsored by Edison; hence the appearance in 1884 of Sprague's Electric Railway & Motor Company, a bold scheme in which he claimed afterwards to have been "electrician, office boy, treasurer, engineer and other staff."

After this system had been exhibited at the electrical exhibition at Philadelphia, Sprague's electric motors working at a constant speed, not known until then, were used by the Edison companies. Even bolder was Sprague's taking on what he called a "foolish contract" to equip an American railway in 90 days with electric motors, the price being over $100,000 if proved satisfactory. Yet despite innumerable difficulties, with steep gradients to be surmounted en route, success was attained, so that a number of contracts for "Sprague railroads" in the United States and abroad were forthcoming.

An example of Sprague's versatility came in 1890 when after the Edison General Electric Co. took over his business, he took up "vertical" traction. The Sprague Electric Elevator Co. built more than 600 lifts before it was turned over to the Otis concern. Next came Sprague's multiple-drive electric trains designed to obviate the bugbear of slipping wheels when single locomotives were used. Such was the superior acceleration that in 1897 the Chicago Elevated Railroad adopted the multiple-drive system.

With Sprague founding his "Safety Control & Signal Company" and introducing automatic train control, with his pioneering of electrical driving equipment from the smallest of dentists' drills to large-scale machinery, this holder of the Edison Medal and one-time president of the American Institute of Electrical Engineers deserves better recognition from posterity.—M.S.

Import Guide

The Purchasing Officers' Association, Wardrobe Court, 146a, Queen Victoria Street, London, E.C.4, has published (at 3s 6d) "The Importation of Goods: A Buyer's Guide to Import Procedures," by Mary W. Hulm, B.Com. This 32-page booklet deals with such matters as import duties, drawbacks and allowances, excise duties, import licensing control, procedure and documents, marine insurance and international agreements.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

At the annual general meeting of the Scientific Instrument Manufacturers' Association held at the Savoy Hotel on 5th July, **Mr. P. Goudime,** M.A., managing director of Electronic Instruments, Ltd., was elected president for 1957-58. Mr. Goudime has been prominent in S.I.M.A. circles for many years, notably in connection with the Electronics Section of which he has been chairman.

The retiring president is **Mr. G. A. Whipple,** M.A., M.I.E.E., F.Inst.P., chairman and managing director of Hilger & Watts, Ltd., who now becomes a vice-president. Elected at the same time as vice-president (president-elect), was **Mr. R. Barrington Brock,** M.B.E., F.R.I.C., B.Sc., director of Townson & Mercer, Ltd.

Mr. R. Isdell-Carpenter has been appointed general sales manager of the Hotpoint Electric Appliance Co., Ltd., and is at head office, Crown House, Aldwych, W.C.2. Mr. Isdell-Carpenter was educated at Marlborough and St. John's College, Oxford. He was called to the Bar in 1932, and practised until 1936, when he joined Unilever, Ltd. During the war he served as deputy senior personnel staff officer at Headquarters, Bomber Command, and afterwards returned to Unilever as chief training officer in the personnel division. In 1951 he joined Hudson & Knight, Ltd. He joins the Hotpoint Co. from the Linoleum Manufacturing Co., Ltd., with whom he has been general sales manager for the past two years.

Mr. R. Isdell-Carpenter

The Midlands Electricity Board announces changes in organisation and management in its Worcester Sub-Area, the manager of which is **Mr. R. Mallet,** B.A., M.I.E.E. The Sub-Area is at present divided into seven districts, Banbury, Bromsgrove, Evesham, Kidderminster, Redditch, Stratford-on-Avon and Worcester. It has now been decided to amalgamate the Bromsgrove and Redditch districts and there are to be managerial changes, expected to take effect on 1st October.

The post of manager of Banbury District has been vacated by the transfer to the Yorkshire Electricity Board of **Mr. H. Eagles,** B.Sc., A.M.I.E.E. To succeed him the M.E.B. has appointed, with effect from 1st August, **Mr. J. Pearson Smith,** A.M.I.E.E., formerly sub-district manager of the Hornsea and Withernsea District of the Yorkshire Board.

Mr. E. B. Willis, Assoc.I.E.E., at present manager of the Kidderminster District, becomes manager of the combined Bromsgrove and Redditch District. From 1948 to 1954 Mr. Willis was manager of the M.E.B.'s Bromsgrove District. **Mr. E. C. Eades,** Assoc. I.E.E., at present manager of the Stratford-on-Avon District, will be transferred to Kidderminster as manager. Mr. Eades previously held posts with the M.E.B. at Bromsgrove, Church Stretton and Kidderminster. **Mr. G. A. Paisley,** B.Sc., A.M.I.E.E., manager of Redditch District, will be tranferred to Stratford-on-Avon as manager. **Mr. J. L. Carson,** B.Sc., A.M.I.E.E., manager of the Bromsgrove District, will become manager of the Bromsgrove Branch forming part of the enlarged Bromsgrove and Kidderminster District. **Mr. J. Johnston,** A.M.I.E.E., remains manager of Evesham District, and **Mr. E. C. Watson,** Assoc.I.E.E., remains manager of Worcester District.

On retiring from the post of director and secretary of the British Electrical Development Association, after service with the Association since its inception in 1919, **Mr. Victor W. Dale,** Companion I.E.E., was presented by the E.D.A. staff with a portable radio set and a "Victor" wardrobe suitcase. Mr. J. I. Bernard, M.I.E.E., Mr. Dale's successor, presided over a company of about sixty, which included some former members of the E.D.A. staff, and paid tribute to Mr. Dale's assiduous work in building up the Association to its present authoritative position in the electricity industry. He also spoke of the cordial relations which had always existed between Mr. Dale and the Association's staff.

The presentation was made by Mr. W. C. Spooner, E.D.A. administrative officer, the senior male member of the staff, and tributes to Mr. Dale were paid by Mr. E. J. Dowson, the E.D.A. liaison officer for the South West England and South Wales areas, and Mr. B. R. Vickers, South of Scotland Electricity Board, who was the Association's area officer for Scotland before nationalisation of the electricity supply industry.

Mr. Frederick Bentham, F.I.E.S., the author of the article on "Television Studio Lighting" (page 95), has been responsible for research and development in the Strand Electric & Engineering Co., Ltd., for 25 years. He introduced the lanterns known as "Acting Area," "Pageant," and the "Mirror Spotlight" which are now characteristic of the British stage lighting installation. His particular interest is electrical control of stage lighting and in 1934 he invented the light console from which the stage lighting at the Drury Lane, Coliseum, Palladium and other large theatres is now controlled. In the past three years he has developed all the lighting control systems used for the larger television studios in this country.

Mr. F. Bentham

Mr. J. H. Rivers, chief designer and technical director of Craven Brothers (Manchester), Ltd., has retired from that position, but will act as engineering consultant and adviser to the company.

Under the terms of the scheme to commemorate the late Lord Rutherford, the following appointments have been made by the Council of the Royal

Presentation to Mr. V. W. Dale. Left to right: Mr. W. C. Spooner, Mr. Dale and Mr. J. I. Bernard

Society:—**Professor E. N. da C. Andrade,** F.R.S., has been appointed Rutherford Memorial Lecturer for 1957, to deliver the lecture in Australia during September - October, and **Professor P. M. S. Blackett,** F.R.S., has been appointed for 1958, to deliver the lecture in Canada.

Mr. S. L. Surange, a graduate of the University of Lucknow, now working at the National Physical Laboratory of India, has been appointed Rutherford Scholar for three years from 1st October, to carry out research in low temperature physics at the Royal Society Mond Laboratory, Cambridge.

The honorary degree of Master of Science was conferred on **Mr. A. N. Irens,** chairman of the South Western Electricity Board at Bristol University Degree Congregation last week.

Mr. J. P. Cranmer, M.I.E.E., has retired after forty-five years' service with the British Thomson-Houston Co., Ltd. He joined the B.T.H. Co. at Rugby in 1912 and worked in the turbine factory for twelve months before being transferred to the Test Department. His training was interrupted by the 1914-18 war when he served in the Army, attaining the rank of captain, Royal Field Artillery. On demobilisation he rejoined the B.T.H. in the Test Department, but soon afterwards became a member of the staff of the Contract Department (switchgear section), going with the section to Willesden in 1927 and remaining there until 1948 as senior switchgear contract engineer. In 1948 Mr. Cranmer joined the staff of the B.T.H. Birmingham district office as engineer, Midlands area.

Mr. J. P. Cranmer

Mr. Cranmer was for four years part-time lecturer in electrical engineering at the Rugby College of Technology and Arts, and later, when he moved to the London district, held a similar position for twelve years at Regent Street Polytechnic.

Mr. J. W. Simpson, A.M.I.E.E., has been appointed chief electrical engineer to the Coniston Co., engineering consultants, Eagle House, Wimbledon. He was previously an electrical engineer in the technical division of Unilever, Ltd., London. Mr. Simpson was educated at the Shaftesbury Grammar School, and after an engineering apprenticeship with the British Thomson-Houston Co., Ltd., he was employed on designing and supervising the erection of electrical services for the company's factories.

On 1st July **Keith Blackman, Ltd.,** introduced a scheme of long service awards, when presentations of wrist watches were made to 165 employees at the Tottenham head office and works by Mr. D. S. Woodley, chairman and managing director, and to fifty-three at Arbroath by Mr. W. G. Calder, director and works manager, while the remaining awards were made to representatives at the various branch offices and the London area sales office.

Gifts from colleagues marked the retirement on 4th July of **Mr. H. T. Taylor,** who has completed forty-nine years' service with Premier Electric Heaters, Ltd., Birmingham, now merged into the Hotpoint Electric Appliance Co., Ltd. Mr. D. H. Graham, director of design, made the presentation, which comprised a Black & Decker drill, with sander, polisher, hedge-trimming and pruning attachments. For Mrs. Taylor there was a bouquet, presented by Mrs. M. Wilson, forewoman, Flex Department.

Mr. Graham recalled that Mr. Taylor joined Premier a year after the enterprise was founded in 1907 and he had been responsible for the testing of its products.

Mr. G. F. Travis, of Connollys (Blackley), Ltd., has been elected chairman of the Covered Conductors Association. **Mr. V. H. C. Phillips,** of Kent Bros. Electric Wire Co. and E. H. Phillips, Ltd., has been elected vice-chairman. **Mr. F. L. Ball,** A.C.I.S., has been appointed secretary of the Association.

Sir Charles Lillicrap, K.C.B., M.B.E., and **Mr. J. Strong** have been re-elected for a second year as president and vice-president, respectively, of the Institute of Welding. Sir Charles is a former Director of Naval Construction of the Admiralty. Mr. Strong is the chairman of Quasi-Arc, Ltd.

The article in this issue on "Flameproof Apparatus" is written by two authors on the staff of British Jeffrey-Diamond, Ltd. **Mr. J. W. L. Anderson,** B.Sc., A.M.I.Min.E., joined the company in 1933 and after serving as a district technical manager was appointed a director in 1946. He was educated at Clifton College and Birmingham University, holds a first class certificate of competency under the British Coal Mines Act, and is a bronze medallist of the National Association of Colliery Managers. **Mr. H. J. Carter,** chief electrical design engineer, joined the company in 1949 after receiving training with the Tredegar Iron & Coal Co. and the National Coal Board. He received his technical education at the Technical College of Monmouthshire, Crumlin.

Mr. J. W. L. Anderson

Mr. H. J. Carter

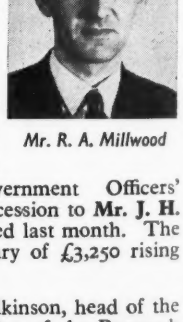
In our last week's report of the luncheon of the **Electrical Industries Club** we mentioned the presentation

Mr. A. F. Plummer presenting the golf cup to Mr. P. C. Wardle

of awards to the successful competitors in the recent Club golf competition. We now reproduce a photograph showing Mr. A. F. Plummer, the Club's president, presenting the *Electrical Journal* Cup to Mr. P. C. Wardle (Revo Electric Co.).

Colonel E. J. S. Ward, M.V.O., M.C., has recently been appointed a director of the two sister companies, Chilton Electric Products, Ltd., and the Chilton Aircraft Co., Ltd.

Mr. R. A. Millwood, manager of the Service Department at the Siemens Edison Swan works, Brimsdown, has been appointed service supervisor for the whole of the country for Ediswan Mazda cathode-ray tubes and valves.



Mr. R. A. Millwood

Mr. W. C. Anderson has been appointed general secretary of the National and Local Government Officers' Association in succession to **Mr. J. H. Warren,** who retired last month. The post carries a salary of £3,250 rising to £4,000 a year.

Dr. K. J. R. Wilkinson, head of the Engineering Division of the Research Laboratory, was chief guest at the Parents' Day of the **B.T.H. Willesden Works Apprentice Association.** The 200 parents who attended this popular open day were conducted around the works by apprentice guides during the afternoon, and after being welcomed by Mr. E. Alexander, manager of the Willesden Works, saw Dr. Wilkinson present essay prizes to J. R. Last (silver medal), N. Bullen, H. J. Gann, D. E. Howard, M. S. S. Bone, H. D. C.

Bean and J. A. Kirby. The apprentice supervisor, Mr. I. H. Child, announced that H. Marks and A. G. Moss, craft apprentices, had been promoted to the drawing office pool.

Mr. A. E. Shilling has been appointed a director of the London Electric Wire Co. & Smiths, Ltd., on relinquishing his position as director and secretary of the Covered Conductors Association. Mr. Shilling rejoins the L.E.W. Co. after twenty-seven years with the C.C.A. At a recent farewell luncheon attended by representatives of all members of the Association he was presented with a gold cigarette case.

Mr. C. J. Margerison has recently retired as managing director of the Wholesale Electric Co., Ltd., of London and Lewisham, having sold his interests to L.E.S. Distributors, Ltd., and at a farewell dinner in London recently he was presented with a silver tea tray and silk umbrella by his co-directors and staff. Mr. Margerison was educated at Birmingham Technical School and served five years' apprenticeship with Veritys, Ltd., at their Aston Works. After some years with Vickers, Ltd., and the Westinghouse Co., he came to London in 1910 and spent a further ten years in the manufacturing industry, and finally entered the wholesale trade, by purchasing in 1926 the assets of the Wholesale Electric Lamp Co., Ltd., the title of which was shortly after altered to the present one.

Mr. H. G. Puttick has resigned his position as technical director of Petbow, Ltd. With the support of local professional and business interests he is forming a new company, Grahame Puttick, Ltd., to produce diesel-electric plant and automatic control gear, and he will act as managing director. Negotiations are proceeding for a factory near Canterbury which it is expected will be operating by next month.

The **Electrical Industries Benevolent Association** informs us that as a result of the sale of flags, collecting boxes, donations, etc., a total of £171 10s 8d was raised at the recent British Electrical Power Convention at Eastbourne. The Association wishes to thank all those who assisted in this effort.

Mr. John S. Webster has been appointed joint managing director of the Sheffield Twist Drill & Steel Co., Ltd. Mr. Webster has been with the company for forty-three years and has been a director for seven years. **Mr. C. P. Morley** is appointed works manager of the Summerfield Street works and **Mr. G. Orwin** works manager of the Solferino Street works.

British Insulated Callender's Cables, Ltd., announces the appointments of three branch managers of sales offices in Lancashire. As a result of these appointments, **Mr. C. R. Bryant** is now manager of the Manchester office, **Mr. F. L. Johnson** is manager of the Blackburn office and **Mr. T. Noblett** is manager of the Preston office.

OBITUARY

Mr. A. E. Millard, former managing director of Walsall Conduits, Ltd., died on 5th July. He retired from that position in 1955 after fifty-one years' service, but retained his seat on the board.

The late Mr. A. E. Millard

Mr. Millard commenced his career with the company (then Walsall Hardware Co.) as an office boy in 1904 and later became general manager of the Ablewell Street premises, Walsall. The whole of the manufacturing side of the company was transferred to Excelsior Works, West Bromwich, in 1929 to join the tube mills and part of the iron foundry which were already there. When the company was made public in 1936 Mr. Millard was appointed managing director.

WILLS

Mr. P. W. Walton, hydraulic and electrical engineering area manager for Mather and Platt, Ltd., who died on 30th April last, left £13,582 gross (£12,431 net).

Mr. R. B. Whitfield, retired electrical engineer, last surviving partner of McClure and Whitfield, Mersey Dynamo Works, Stockport, who died on 23rd February last, left £40,613 gross (£40,475 net).

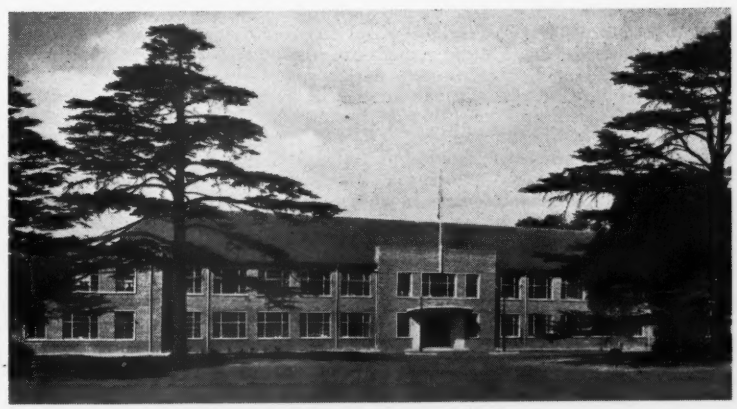
Mr. A. W. Isenthal, founder member of the Röntgen Society (now the British Institute of Radiology), died on 31st March last, leaving £11,722 gross (£11,547 net).

Mr. G. A. Vowles, O.B.E., M.I.Mech.E., formerly controller of the Yorkshire Division of the C.E.A., who died on 7th April last, left £9,052 gross (£7,963 net).

Eastern Division Headquarters

New divisional headquarters offices for the Eastern Division, Central Electricity Authority, were officially opened last Friday at West Farm Place, Cockfosters. Sir Henry Self, deputy chairman (administration), C.E.A., performed the opening ceremony and after a short speech during which he paid tribute to the controller, engineers and staff of the Division, dedicatory prayers were said by the Rev. J. C. P. Barton of Christ Church, Cockfosters. Included in the platform party were Mr. C. T. Melling, chairman of the Eastern Electricity Board, and Mr. W. N. C. Clinch (controller), who afterwards presented Sir Henry with a suitably inscribed electric tea making set to mark the occasion.

The original house at West Farm Place, which dates back to the last century, was purchased in 1948 and although at that time it was not large enough to accommodate all the headquarters departments the grounds provided adequate space for future development. It is in these grounds that the new building has been erected and now for the first time the majority of the divisional headquarters staff are housed on one site. The building and layout was designed by the divisional architect and the work carried out under the supervision of the staff of the construction department. Many features of the building are of interest, especially the "Panelec" heating system which comprises electric underfloor heating supplemented by heated panels built into the walls under windows, both floor and panels being thermostatically controlled. Special attention has also been given to the lighting in all rooms and offices which is mainly fluorescent. The main contractors were W. & C. French, Ltd.



West Farm Place, Cockfosters, the new divisional headquarters offices of the Eastern Division, Central Electricity Authority

ELECTRICITY BILL

Final Stages in the Commons

THE Electricity Bill, which was first presented to the House of Commons on 27th November, 1956, was passed through its remaining stages last week.

When the Commons considered the Lords' amendments there was general agreement with their terms, although Sir Frank Soskice regretted that the Government had not agreed to allocate one of the independent seats on the Electricity Council to a representative of the trade unions.

Mr. Maudling, Paymaster General, explained that a Lords' amendment provided that in appointing the independent members the Minister of Power should have regard to people who had experience of the generation or supply of electricity, industrial, commercial or financial matters, applied science, administration or the organisation of workers. It was thus clear that the Minister could have regard for a man who had experience in the organisation of workers. The record of the Government showed that they had a proper appreciation of the service that trade union leaders rendered to the country.

To have allocated a seat on the Council specifically to the trade unions would have led to other demands and the Government would find themselves compelled to allocate other seats for particular interests or organisations. That would inhibit the Minister from appointing the best possible Council.

Membership of Council and Boards

Referring to an amendment relating to whole-time members of the Council and the Boards, Mr. Palmer welcomed the change of tendency towards strengthening the whole-time membership. That was excellent for the Generating Board and the Electricity Council, he said, though he hoped a differentiation would be made between the Generating Board, which was a production body having a big functional, technical job to do, and the Area Boards. There was a strong case for having more whole-time members on the Generating Board and in the Area Boards the emphasis should be on the representation of those interests which were natural to the locality and which had some bearing on the interests of local consumers.

When the new clause relating to the placing of electric lines was considered, Labour members wondered whether the Minister would now be open to be questioned in the House on every wayleave, but Mr. Maudling said that the Minister would be no more and no less responsible to Parliament in future. His consent had always been subject to challenge in Parliament.

The main debate took place on a Government amendment to the Lords' new Clause D (special provisions as to public inquiries). Mr. Maudling explained that the new Clause provided for a public inquiry not only if the local planning authority should object to a proposal, but if that authority should inform the Minister that other persons were aggrieved by the application. The effect would be that if any two people objected the Minister would be bound to hold an inquiry.

"There are a number of reasons why the Government find this unacceptable," he said. "The Minister has to deal with about 9,000 or 10,000 applications for overhead lines annually, and if we had to have a public inquiry every time two people objected the effect on the power programme would be insupportable."

He therefore moved an amendment to provide that where application had been made to the Minister and the local planning authority had informed the Minister that it objected, the Minister should hold a public inquiry. The amendment also provided that the Minister should be able and obliged to listen to objections from other quarters. Its effect would be roughly that, in the case of high voltage lines (to be defined as lines for conveying electricity at or above 132 kV), if anyone had an objection he should send it both to the planning authority and the Minister. Thus the Minister would have the whole picture of the objections to the line and would be able, if he thought it right, to hold a public inquiry into objections from sources other than the planning authority.

This had happened in the past, as in the case of the Bradwell power station. No objection was raised locally, but the Minister felt it right to have a public inquiry because of the importance of the project.

Under the amendment, if the local planning authority said that there were substantial objectors, like the Council for the Preservation of Rural England, the Minister would have discretion to order a public inquiry. Underlying the whole provision was the feeling that if the planning authority objected there should be a public inquiry, and if there were objections from other sources the Minister could decide in his discretion whether they should be dealt with by private hearing or whether they were adequate to merit the full machinery of the public inquiry.

The point raised in the Lords was a valid one, but he also felt that Parliament should not do anything which would impede or hold up the expansion of the electricity supply industry. By amendment to the Lords' new Clause and with some ingenuity on the part of the draftsmen, they now had the best of both worlds.

Mr. C. R. Hobson considered it a step in the right direction because the original new Clause was thoroughly impracticable, and would have impeded the programme. But why was it necessary to have a datum line for high voltage lines at 132 kV ?

Mr. Maudling said they felt it was quite impossible to apply this procedure to every application for an overhead line. Most controversy and discontent was caused by the large overhead lines carried on big pylons. The datum line was intended to include these but to exclude the normal overhead distribution lines.

Sir Frank Soskice called the amendment a reasonable compromise which should allay a number of conflicting anxieties. It was a sensible middle way between two opposing points of view.

The amendment was agreed to.

Preservation of Amenity

Presenting another Lords' amendment relating to the preservation of amenity, Mr. Renton, Parliamentary Secretary, Ministry of Power, said that the peers had shown a passionate interest in beauty, physiography, and especially flora and fauna. The Clause was a valuable addition to the Bill. It would mean that when there were known to be, or thought to be, interesting fossils at places where excavations were made, the fossils could not be disturbed until the find had been carefully examined. Buildings and other objects of architectural and historical interest would also be protected. When proposals were being made for a new power station, for example, both the Generating Board and the Minister would have to bear these things in mind.

Mr. Hobson declared himself opposed to the new Clause because it was far too restrictive and he could see no reason for it. The Boards already had regard to these things, he said, but there was a world of difference between a commonsense approach and having this closely drawn Clause in an Act. What was meant by "conserving the fauna"? Where could we site atomic stations without affecting some fauna, such as deer in Scotland, or rabbits? Did it cover badgers? The whole thing was stupid. The proposal to have a station at Bradwell raised a flurry about whether or

not a Georgian mansion was an ancient building. The same sort of thing would happen all over the country. He could not understand the Government accepting the Clause for it would cause a tremendous number of legal actions.

Mr. Ray Mawby supported Mr. Hobson and said we could look forward to many lawyers' field days, because the Clause contained many vague definitions. Parliament was calling on the Boards to carry out obligations which they had already voluntarily accepted over a number of years.

Mr. Palmer said he understood the doubts which had been expressed but it could not be doubted that there had been a strong expression of feeling that when the power programme was extended the authorities should take account of amenity considerations. He spoke for the majority of Labour members when he said that they felt the Clause should be given general support.

The difficulty seemed to be on the æsthetic side. What was to be the standard of taste in these matters? Would the Electricity Boards appoint "flora and fauna officers"? Unkind critics of the Boards had occasionally talked about a "bereavement officer"—quite a mythical figure! If, in addition, there was to be a "flora and fauna officer," there would be no end to the scope for jokes by comedians on the music hall stage. He was all in favour of protecting beauty; the difficulty was to define natural beauty.

Sir Thomas Moore supported the Minister. He said the countryside was threatened by new pylons of strange design—"Heath Robinson in character"—which were destroying the vista, and practically everything that gave satisfaction to the eye.

Mr. Renton assured Mr. Mawby that it would not result in a lawyers' paradise. All that the new Clause required was that the Boards and the Minister should take into account these various things. It was not every sparrow that had to be protected. It was not every stone. It was when things were of special interest that they had to be taken into account. It would not become an overriding factor which would decide every case. An Electricity Council was being set up with new responsibilities and it was right that the Act should remind them of the public anxiety which existed about these matters. There would not be a "flora and fauna officer" or an "ancient buildings officer." Consultations already took place with the interested organisations on these subjects.

The amendment was agreed to.

Another Lords' amendment dealt with what Mr. Renton called "a legislative fossil." It repealed a section of the Electric Lighting Act, 1882, which had in turn adopted a section of the Gasworks Clauses Act, 1847, dealing with the misuse of gas, so that it applied to electricity. It did this by providing that "gas" meant "electricity" and "gas pipe" meant "electric lines"!

Humorously, Sir F. Soskice said this was enthralling; what puzzled him was how these remote provisions escaped the vigilance of M.P.s during the committee stage!

All the Lords' other amendments were agreed to, and this was duly reported in the House of Lords. Now all that is needed is the Royal Assent.

PARLIAMENTARY REPORT

Progress of Railway Plan

Statements about the manner in which the British Transport Commission is placing contracts for electrical equipment in connection with the railway modernisation programme were made in the debate on the British Railways in the House of Commons last week. A spokesman for the Government gave an undertaking that an investigation would be made to see that the Commission's purchasing policy was in the national interest.

Opening the debate, Mr. Watkinson, Minister of Transport, said that the modernisation programme launched in 1955 was beginning to bear fruit. By the end of 1956 nearly 400 diesel train sets had been delivered—two and a half times more than in the previous year. Remarkable increases in receipts had followed. Deliveries had begun of some of the 230 diesel main line locomotives which had been ordered. Of this total, 43 were being made in B.R. workshops and 187 by outside contractors. Further orders were about to be placed, and, as the whole procurement programme totalled only about 2,500 main line diesels, it could be seen that the next stage from the multiple-unit diesel was now well in hand.

In November, 1955, the Transport Commission announced its intention to buy 174 diesel locomotives as pilot models. The Commission had since come to the conclusion that if it was to maintain its planned programmes, it had to go ahead more rapidly with diesel locomotives. That was why it proposed to order more, and this might well bring the rate of production above the figures quoted in the White Paper on modernisation.

The next stage was electrification, on which the Commission's main hopes were based—because the diesel on the main lines was only an interim phase. After 1961 the Commission hoped to step up the pace of electrification and the first main line electric locomotives were expected to be in operation in October, 1958, on the Manchester to Crewe section. Many works on the track, signalling and structures had to be undertaken and this part of the programme was going according to plan.

To attract more freight traffic was vital to the future of the railways, and the modernisation of freight handling equipment was the crux of the development plan. The fitting of continuous electric brakes, so that freight trains could run faster, was a most urgent matter and the planned programme for this work was being exceeded in the current year.

Mr. Ernest Davies thought the Commission's annual report for 1956 referring to the attempt to gain traffic made sad reading, but he was glad that there was a tendency for passenger traffic to increase. This was almost certainly due to the modernisation which was progressively taking place in dieselisation and electrification. Members who recently visited the French railways were much impressed by the high speeds which the French maintained by using diesels and electrified services; the overall average was 70 m.p.h. including stops.

He had heard it suggested that the modernisation plan would now cost £2,000 million instead of the £1,200 million estimated. In these circumstances it was important to keep costs low, and the Commission was wrong to place orders without inviting tenders openly. It appeared that on occasions certain experienced firms which had been contracting with the Commission over a long period had been employed without alternative tenders being invited. The cost-plus system should be avoided.

Mr. Leslie Thomas hoped that if the Chancellor had occasion to put a brake on capital investment, he would leave the railways out of it. The urgent need was to press on with modernisation and get the plan fulfilled in under the 15 years envisaged. That would require co-operation from the industries supplying equipment. If they expected large orders from the Commission they should put their plant in order and expand it.

Mr. Humphrey Atkins appealed for better underground services to South London. He said the solution proposed by the London Traffic Plan Committee in 1946 to duplicate the Northern Line seemed as far away as ever. The new Victoria line, which

had a higher priority, had not been started, the reason being lack of finance.

Mr. George Darling said that the Minister had mentioned, as if it were a great achievement, that the Commission had 230 main line diesel locomotives on order. At this rate of progress it would take a long time to replace our 19,000 steam locomotives with diesel, diesel-electric, or electric locomotives. Mr. Watkinson said that he was talking about main line diesels; there were many hundreds of diesel shunting engines now in use.

Mr. George Strauss said that most of the £1,200 million to be spent on modernisation would go on equipment. Orders were being placed with an overloaded industry, so there was a sellers' market. It was a situation of latent danger, which might add tremendously to the cost of the scheme, burdening the railways with interest charges of millions of pounds a year. The weak point in the whole of the set-up was the purchasing system. The traditional policy was to buy major equipment from a few well-known suppliers who had given good service in the past rather than go in for competition.

Mr. Strauss said he was told that orders had been given to an old and large firm, very well known and for a long time a supplier to the railways, for the manufacture and installation of the overhead catenary—the wires, supporting posts and so on—which was required for the electrification of the railways. The order was for all that quantity which the B.T.C. would want for the first five years of its programme. The total amount for the whole programme was likely to amount to about £30 million. The contract had been placed on a cost-plus basis. Other firms of high standing asked to be allowed to make competitive tenders for sections of this work. Finally, they were allowed to do so, but they maintained that the conditions laid down by the Commission made effective competitive tenders impossible.

Mr. Nugent, Parliamentary Secretary, Ministry of Transport, said that the general practice of the Commission when placing contracts was to purchase by competitive tender. No exceptions were permitted without the express approval of the Commission. But they acted as any sensible firm would do, recognising that there might be circumstances in which it would be justifiable to purchase without tender. In the case of the contract mentioned by Mr. Strauss, he (Mr. Nugent) was informed that the firm the Commission went to was the firm with the experience for the job, pre-eminent in the Commission's judgment, and alone capable of doing the designing work. A condition imposed by the firm concerned was that if they were to do the designing work they wished to do the supplying as well. That, of course, created just the difficulties which Mr. Strauss had referred to, in making it virtually impossible for other firms to do parts of the construction work.

Mr. Strauss said that those firms, which were of equally high standing in the industry and had a world-wide reputation, maintained that with the French experience they could do the designing work just as well but were not allowed to show and prove their mettle.

Mr. Nugent said that he and the Minister of Transport undertook to look into the whole situation with the Commission and assure themselves that the matter was being dealt with in the national interest. He would be grateful if Mr. Strauss would send him privately the names of the firms concerned.

Continuing, he said that the Commission had been in consultation with the National Coal Board and the Central Electricity Authority with the result that there had been a significant increase in the amount of coal being carried by rail rather than by road.

Hastings Transport Bill

The Hastings Corporation (Tramways) Bill, which gives powers for the electric trolley-buses of Hastings to be replaced with diesel buses, received an unopposed second reading. Mr. Nabarro, supported by other M.P.s, had down a motion opposing the Bill, but for this to have been debated it was necessary for them to object to the Bill each time that it was called for second reading at the commencement of Parliamentary business. Through some misunderstanding among the Bill's opponents no-one was there last week to cry "Object!" so the Bill now goes to a Private Bill Committee for consideration. As a last-minute attempt to retrieve his position, Mr. Nabarro has put down a motion in these terms: "That the case of the ratepayers and residents in the County Borough of Hastings, calling themselves the 'Save our Trolleys' Committee, who petitioned against the Hastings Tramways Bill, within the time limited by Standing Orders, be referred back to the Court of Referees." Two weeks ago the Court of Referees reported to the Commons that the *locus standi* of this committee had been disallowed by them. Mr. Nabarro now seeks to get this decision reconsidered. If the motion is debated it will be the first time such a motion has been debated since 1890.

Exchange of Atomic Energy Information

Mr. Gower asked the Paymaster General whether any information had so far been exchanged under the agreement with the United States for co-operation in the civil uses of atomic energy which had proved to be good business from Britain's point of view. He queried whether we had not been giving away information which in the long run might be much more useful than the information we had obtained.

Mr. Maudling said that in agreements of this kind it was wrong to try to balance one item against another. Over the period of the operation of the agreement, both sides had obtained great benefit.

Mr. Peyton: Will the Minister bear in mind that for one reason or another the United States Government have been extraordinarily niggardly in their co-operation since the war? Will he assure the House that our hard-won advantage—it was won at great cost—will not lightly be cast away?

Mr. Maudling, in reply, said that was much in the mind of the Minister of Power.

Fatalities in the Home

Mr. Hastings asked the Secretary of State for the Home Department whether, in view of the 55 deaths by electrocution in the home in 1956, he would introduce the necessary legislation to ensure the annual inspection of all hired electrical equipment.

Mr. Butler replied in the negative and said that his information was that few accidents were caused by faulty electrical appliances, and that hired appliances were regularly maintained by the owners.

Atomic Power Plant Sites

Sir Ian Fraser asked the Paymaster General whether a decision had yet been reached on the siting of new atomic power plants and what safeguards he had in mind to preserve the amenities of the countryside.

Mr. Maudling said that the Government had decided that, for the present, nuclear power stations should be sited away from centres of population, and he could not yet say how long it would be before sufficient experience had been gained to enable this decision to be reconsidered. Meanwhile the Minister of Power would continue to do everything possible to avoid any unnecessary damage to the amenities of the countryside.

Fuel Efficiency

In a debate on coal prices, Mr. Palmer asked the Paymaster General if he would give the approximate quantity, and the estimated value, of the coal saved in the nationalised gas and electricity industries due to increased efficiency of fuel utilisation, since vesting date in each case.

Mr. Maudling replied that for gas it was nearly 10 million tons, worth some £40 million, and for electricity about 35 million tons, worth some £120 million.

Mr. Palmer said that industry could have made a better effort to counteract the alleged inflationary effect of increased coal prices by improved fuel efficiency.

Mr. Maudling agreed that industry could use fuel more efficiently; what the country needed was greater fuel efficiency and not more expensive coal.

VIEWS on the NEWS

By REFLECTOR

AFTER the inspection of about 2,400 installations carried out by firms and individuals on the Roll of Approved Electrical Installation Contractors, the National Inspection Council finds that only 7 per cent were satisfactory in every way. On the other hand only 1 per cent were really of a low standard and these were attributed to inadequate supervision or lack of suitable testing equipment. The remainder, i.e. the great majority, disclosed minor departures from good practice, or minor infringements of the regulations. Where shortcomings are discovered the delinquents are told about them and their work is again inspected after six months has elapsed. This should help to clean up the contracting industry, but, of course, it leaves untouched those who are not enrolled. Only the acquaintance of the public with the enrolment scheme can eliminate the unfit and that means a great deal of publicity.

* * *

I do not know what authority *The Field* has for saying that the C.E.A. does not regard the "present network of overhead cables and all the other unsightly paraphernalia of the electricity supply system as a permanent feature of the British landscape, but as a relatively temporary expedient." The magazine goes on, however, to visualise complete underground transmission by cables in ducts common to many services. It ends its comments with the following paragraph:—

> "The crux of the matter is that one day, later if not sooner, the proliferation of cables and wires over our heads will cease to be tolerated, and all of them will go underground. A nation which can build a Calder Hall and similar plants to generate its electricity will demand, and deserve, nothing less."

* * *

Quite a few members of the electrical industry, mainly in the supply section, met Mr. G. M. Malenkov when he visited this country last year as the head of a delegation from the Soviet Union. Many of them renewed the acquaintanceship when as delegates from the electricity supply industry they paid a return visit to Russia. The general impression was that he was of a genial nature and there will be some regrets at his deposition from the post of Minister of Electric Power Stations and his virtual banishment to take charge of the Ust-Kamenogorsk hydro-electric station about 2,000 miles from Moscow.

* * *

My recent note on the discussions between the Electrical Power Engineers' Association and the Association of Managerial Electrical Executive seems to have perturbed some members of the latter body who envisage a sort of swallowing process in which they would be the victims. I am assured that their worry is quite unjustified. The approach from the E.P.E.A. was made purely with a view to the improvement of the negotiating arrangements in the higher flights of the electricity supply industry. The purpose of the talks has been only to explore the possibility of a closer linking-up of the two associations to secure greater efficiency in dealing with the negotiating problems of the higher managerial and executive staffs.

* * *

A reader in Ireland has raised the question of the transmission of power through the atmosphere. Experiments have been carried out in the past on the transmission of electrical energy through the air; up to a point they were successful, but had no practical application since it was found possible only with very small quantities of electrical energy. My first reaction to the letter was that the gentleman in Ireland was expecting rather too much, even in this year of combined world-wide research. Not many of us really believed we should ever live to see the day when an earth satellite would be launched to circle the earth. We were also sceptical about accurate measurements relating to the ionosphere. However, the earth satellite experiments had the known facts relating to gravity in their favour and the ionosphere experiments the known fact that the atmosphere in the ionised state has the property of reflecting and refracting radio waves. Power transmission through the atmosphere may eventually be possible but I believe that the cable makers need have no qualms yet awhile.

* * *

In this International Geophysical Year it is of interest that the *Electrical Review* of 15th July, 1877 (eighty years ago) contained an article by Professors W. E. Ayrton and John Perry, then at the Imperial College of Engineering, Tokyo, on "The Importance of a General System of Simultaneous Observations of Atmospheric Electricity." In this they mentioned the practical value of such observations "in enabling fairly accurable predictions of the weather to be made some hours in advance." Reference was made to "natural currents" in telegraph lines and the authors said:—

> "During auroras these currents become extremely strong, sometimes as great as can be produced by the employment of a battery of 2,000 Daniell's cells, and occasionally even exceeding this. Of such currents the most extensive set of simultaneous observations that have been made was during the remarkable aurora of 4th February, 1872; but as on that occasion these observations were not the result of any general system of measurement, but owed their origin to the fact that the currents became so strong as to interfere with the working of all the telegraph lines throughout the world, it cannot be expected that any large amount of information can be derived from the mass of records made on that day. One point, however, can be learnt from these observations, and that is this—first, the general direction of the positive currents was from east to west, that is, with the sun; secondly, along lines running north and south the currents were comparatively weak."

INDUSTRIAL NEWS

Approved Electrical Contractors

The first supplementary list of additions to the Roll of Approved Electrical Installation Contractors has been issued by the National Inspection Council for Electrical Installation Contracting, 13, Victoria Street, London, S.W.1. The Roll is a document of over 80 pages in which the names of approved contractors are given in alphabetical and geographical arrangement. It includes the contracting establishments of the Electricity Boards and covers the whole of England, Wales and Scotland.

Copies of the Roll are being sent to all local authorities, firms of architects, consulting engineers, housing associations, Regional Hospital Boards, the appropriate Government Departments, the Gas Boards and Divisions of the National Coal Board. The Council's inspecting engineers are engaged not only in examining the work of applicants for enrolment but also in routine inspections of installations carried out by those already enrolled.

Anglo-American Electronics Company

In our issue of 5th July we referred to the formation of Amphenol (Great Britain), Ltd., by the Gas Purification & Chemical Co. Half of the share capital of £100,000 is being subscribed by the Gas Purification & Chemical Co. and half by the Amphenol Electronics Corporation, of Chicago. The new British company, acting under licence, will offer the entire Amphenol range of electronic components, including electrical connectors, high-frequency connectors, cable and cable assemblies, plugs and sockets.

At a reception held at the May Fair Hotel, London, last week, which was attended by Mr. W. H. Rous (vice-president) and Mr. Gaenslen, of Amphenol Electronics, Chicago, Mr. J. R. Sorsbie (chairman of the new company) said that the main object of the new Anglo-American enterprise was to give British manufacturers access to electronic components that had achieved a large degree of international standardisation. This would have the effect of introducing to the British market components that had not been readily available before.

It would be the policy of the new company to offer immediately the whole range of components shown in the American company's catalogue, but in the early days most of these items would have to come under the usual import licence procedure. They were now preparing for the commencement of production of the more popular ranges in this country, and they expected to be able to deliver some of these before the end of the year. This production was being supervised by Mr. A. Marks, managing director of Amphenol (Great Britain), Ltd., who was also managing director of A. B. Metal Products, Ltd. Mr. G. L. Stephens had been appointed chief engineer.

Careers for Women

A conference on careers for girls in engineering, held by the Women's Engineering Society at Coventry last week-end, was addressed by the Minister of Labour, Mr. Iain Macleod. Calling upon industry to make an immediate appraisal of jobs in industry available to girls with scientific qualifications, he said that they would only get the requisite number of girls with scientific and mathematical training if industry was able to demonstrate that they would find proper scope for their abilities in progressive careers.

Dr. Willis Jackson (Metropolitan-Vickers Electrical Co., Ltd.) spoke of many eminent women engineers on the staff of the company and said there was no doubt about the suitability of women scientists for research and development. He felt that the setting up in Manchester, under the chairmanship of Miss Ann Shaw, of a committee representing the girls' schools, technical colleges, the university and industry to study career possibilities for women was an important step forward.

South African Locomotive Order

An order for 135 electric locomotives valued at over £7,600,000 has been placed by the South African Railway administration with Metropolitan-Vickers South Africa (Pty.), Ltd., on behalf of the Metropolitan-Vickers Electrical Export Co., Ltd. Each locomotive is rated at 2,000 h.p. and is of the four-axle type, weight 80 tons. The electrical equipment will be manufactured at the Metropolitan-Vickers Works at Sheffield and Trafford Park and the mechanical parts will be manufactured and erection of the locomotives carried out at the Stockton Works of Metropolitan-Vickers–Beyer, Peacock, Ltd. The first locomotive is to be delivered within twenty months. This is the largest single order for electric locomotives ever placed by South African Railways.

Contract Price Formulæ

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ.

In each case the rate of pay for adult male labour at 12th July is deemed to be 186s 6d.

The "costs of materials" figures are: For electrical machinery and equipment the Board of Trade index figure published on 12th July is 180·6. For turbo-generating and allied plant: Materials used in mechanical engineering industries 181·3, blast furnaces and iron and steel melting and rolling (40 and 41), 177·9. The price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 12th July) is 45⅝d per lb.

British Instruments at German Exhibition

The Scientific Instrument Manufacturers' Association, in conjunction with the Board of Trade, is showing on a stand of over 2,000 sq ft a representative display of the products of twenty-four of its member firms in the *Interkama* exhibition at Dusseldorf from 2nd to 10th November next. The exhibition, the International Congress and Exhibition of Measuring Instrumentation and Automation, is being held for the first time this year.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £216 15s 0d
Fire Refined 99·70%	ton £215 0s 0d
Fire Refined 99·50%	ton £214 0s 0d
COPPER Tubes ..	lb 2s 1d
Sheet	ton —
H.C. wire and strip ..	ton £265 15s 0d
LEAD, English ..	ton £89 5s 0d
Foreign	ton £88 0s 0d
MERCURY	flask £9 0s 0d
TIN, block (English) ..	ton £748 0s 0d
ZINC, G.O.B. Foreign	ton £75 10s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 8⅞d
Sheet	ton —
Wire	lb 2s 5⅛d
PHOSPHOR BRONZE Wire	lb 3s 9¼d
PLATINUM	oz £34 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 27⅛d—27⅜d

Industrial Re-rating

Changes in the system of local rating are proposed in a White Paper published last week ("Local Government Finance (England and Wales)," Cmnd. 209, H.M. Stationery Office, 1s). The proposals of immediate interest to industry are that industry and freight transport, at present rated at 25 per cent of their net annual value, shall be re-rated at 50 per cent. The Plant and Machinery (Valuation for Rating) Order, 1927, has been rendered out of date by the changes in industrial practice and a committee is being invited to prepare a revised Order; it is the aim to complete this revision by the date on which re-rating and other changes come into operation.

Electricity properties are to be rated

on lines similar to those now operating for gas, with weightings for generation and distribution as outlined in an appendix to the White Paper. Those parts of electricity and gas showrooms used as shops will be separately and directly assessed to rates.

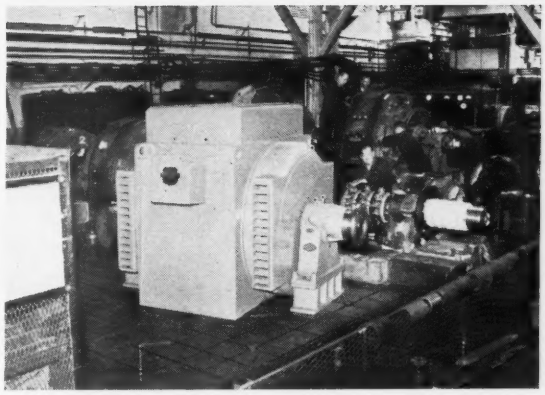
Proposals relating to the Scottish rating system are set out in a separate White Paper ("Local Government Finance in Scotland," Cmnd. 208, price 8d).

Street Lighting Order

The Engineering & Lighting Equipment Co., Ltd., St. Albans, has received the first major order for its newly introduced "Eleco" silver ray lantern. Fifty of these lanterns are to be installed on the new Pelham Bridge, at Lincoln, which is designed to by-pass existing level crossings. This lantern is primarily designed for use with the colour corrected mercury MBF/U 250 and 400 W lamps, but will also take the MA type of lamps satisfactorily. The lantern die casting is in L.M.6, which together with stainless steel hinges and catches, gives the maximum resistance to corrosion whilst light control is achieved by anodised aluminium reflectors in conjunction with the prismatic refractor bowl.

Chester County Hall

Wm. Wadsworth & Sons, Ltd., have supplied two lifts for the new Chester County Hall, opened last week by the Queen. The company has been for some time installing lifts with a new type of variable-voltage drive offering certain advantages over what has been hitherto obtainable. An electronically controlled mercury vapour rectifier replaces the normal motor generator as a winding motor power source. The maintenance costs of a continuously running generator are thereby cut and initial installation expenses are considerably lower. One lift gives access from the main ground floor at the front of the building, and the other is installed near the Castle entrance. Each lift has fully automatic doors and a control system. Similar passenger lifts have been or are being installed for, amongst others, British Railways in Liverpool and London, for offices and flats in London, Johannesburg and Durban, for technical colleges in Glasgow, Liverpool and Manchester.



The prototype of a Lancashire Dynamo 4,400 h.p motor designed for Bradwell power station

Plant for Bradwell

A contract valued at nearly £750,000 has been received by the Tube Investments subsidiary, the Talbot Stead Tube Co., Ltd., Walsall, from C. A. Parsons & Co., Ltd. (a member of the Nuclear Power Plant Co., Ltd.) for specialised atomic reactor components for the Bradwell nuclear power station in Essex. The order includes fuel element support assemblies, charging standpipes, neutron source assemblies, absorber rods, short charge plugs, control rods, and control rod standpipe plug assemblies.

The Lancashire Dynamo Group has substantial orders in hand for electrical equipment for nuclear power developments. The accompanying picture shows the prototype of a special 4,400 h.p. motor, just completed, the first of a number for the Bradwell nuclear station being built by the Nuclear Power Plant Company for the C.E.A. Lancashire Dynamo machines on order for this station total over 60,000 h.p. and range from specially designed high-speed gas circulating motors to small valve operating motors, together with stand-by generators for essential station services, fan, pump, crane and compressor motors, and various turbine auxiliaries.

Kent Agricultural Show

One of the stands which attracted a great number of visitors at the Kent County Agricultural Show held last week at Mote Park, Maidstone, was that of the South Eastern Electricity Board. The stand this year covered a greater area than before (3,800 sq ft) and was worthy of the efforts of the Board's own staff who both designed and erected it.

In the domestic section were five demonstration areas representing cleaning, cooking, home laundry and ironing, and dish washing. Emphasis was placed on the automatic electric cooker and among models displayed were Jackson, Falco "Royal," Creda "Carefree" and Belling cookers. Particular attention was also drawn to the Ferranti "Fridge-Heater" which was shown working. The latest types of refrigerators and ventilation equipment were also to be seen and the "Dishmaster" dish washing machine was continuously demonstrated.

In the agricultural section a medium sized greenhouse was erected and samples of soil warming and sterilising cables, heating equipment, thermostats and plant irradiation equipment were on view.

As in previous years there was an excellent display of dairy equipment and among milking, milk cooling and sterilising equipment shown was the latest "Purlac" milk cooler.

A well set out exhibit demonstrated the "Farmer's Friend" grain cleaning and grading equipment, while the Woolley tunnel dryer, designed for the smaller farmer, was also shown. Other equipment to be seen in this section included a Bentalls' oat crusher, milling and mixing equipment and barn machinery. There was also a special

Lighting fittings form a prominent part of the products displayed in the new showrooms now open at the branch offices of the General Electric Co., Ltd., at Magnet House, Stoney Street, Nottingham

Dr. T. Hammerling (centre) at the B.T.H. Rugby Works, with Mr. E. H. Ball (right) and Mr. H. E. Cox

display of B.T.H. electric motors designed for use on and around the farm. During the period of the show visitors were also able to see the latest E.D.A. farming and domestic films, in colour.

New Thorn Acquisition

Thorn Electrical Industries, Ltd., has acquired ownership of Nash & Thompson, Ltd., of Oakcroft Road, Chessington, scientific instrument makers. The new directors, Mr. D. Talbot and Mr. B. C. Fleming-Williams, state that the broad policy of the company will be unaffected by this change.

Radiography in Nigeria

Solus-Schall, Ltd., has received a contract from Taylor Woodrow, Ltd., to carry out gamma radiography on a 10in pipe line from Port Hardcourt in Nigeria to Oloibiri, near Kuglo, 60 miles away. It is here where the new oil strike has been made, and the line is being constructed for Shell Petroleum (Nigeria), Ltd.

Manchester Electronics Exhibition

The annual Electronics Exhibition and Convention of the Northern Division, Institution of Electronics, was opened on 11th July by Rear-Admiral Sir Philip Clarke. The chairman of the Northern Division of the Institution, Mr. W. H. Kerse, at an exhibitors' dinner the previous evening referred to the great advances which the science of electronics had made possible in research and industry.

Computer for South Africa

The South African Mutual Life Assurance Society is proceeding with its plans for installing a large electronic data-processing system at Mutualpark, Pinelands, Cape Town. This system, known as "Perseus," has been ordered from Ferranti, Ltd., at a cost of nearly £250,000 and is due for delivery in 1958.

Works Visit

Dr. F. Hammerling, director of A.E.G. (Allgemeine Elektricitäts Gesellschaft, Germany), recently made a two-day visit to the Rugby, Leicester (Blackbird Road) and Newcastle (Staffs) works of the British Thomson-Houston Co., Ltd.

During his tour of Rugby Works, Dr. Hammerling, accompanied by Mr. E. H. Ball (managing director, B.T.H.) and Mr. H. E. Cox (manager, Rugby Works), visited the new germanium factory and heavy plant factories. The tour also included the control gear, industrial electronics, and gear-cutting factories. Dr. Hammerling met Dr. A. L. Whiteley (manager, Electronics Engineering Department) for a discussion on electronic developments, and afterwards visited certain sections devoted to electronics. Mr. L. J. Davies (director of research and education) also arranged a programme. On the second day of his tour Dr. Hammerling visited the B.T.H. No. 2 electronics factory at Blackbird Road, Leicester, and then went on to the company's Newcastle Works (Staffs) where fractional h.p. motors are made.

New electric welding processes and products were studied by a party of visitors to the British Commonwealth Welding Conference who recently visited the works and research laboratories of Quasi-Arc, Ltd., at Bilston, Staffordshire. The visitors were welcomed by Mr. J. Strong, chairman, Dr. Nicol Gross, managing director, and Mr. R. Butler, sales director. In addition to entertaining the Conference visitors, Quasi-Arc also held "open days" at the Bilston Works for more than 300 customers from 12th to 20th June.

Diesel-Electric Locos for Ghana

Four Paxman-engined BO-BO diesel-electric locomotives of 400 b.h.p. for shunting work have just been introduced on the Ghana Railways, and are to be followed up by another nine now under construction.

Annual Holidays

The offices and works of William McGeoch & Co., Ltd., will be closed from 26th July to 12th August for the annual holiday.

The works of Transformers (Watford), Ltd., will be closed for the annual holiday from 27th July to 12th August inclusive.

Trade Announcements

The appointments of three new representatives are now announced by **Tricity Cookers, Ltd.** Mr. C. Houghton-Dodd will be covering part of the Eastern Electricity Board area, operating in the Northmet, Chilterns, and Fens territories, Mr. G. Black will be covering the North Western Electricity Board area, and Mr. G. E. Riches will be covering the Southern Electricity Board area.

Mr. R. J. Venn, of Leicester, has been appointed representative for **William McGeoch & Co., Ltd.,** Birmingham, of the new eastern area which includes the company's old east coast area previously covered by Mr. R. Catchpole. Mr. Venn was previously with Thorn Electrical Industries, Ltd., and the Midland Dynamo Co., Ltd.

The **Sheffield Twist Drill & Steel Co., Ltd.,** announces the completion of new extensions and installation of new machinery by its subsidiary company, Accurate Screw Threads, Ltd., Precision Works, Hednesford, Staffs. The company is now in a position to undertake further sub-contract work, including complete assemblies, precision and repetition machining.

The **Bryterlite Electrical Co. (Glasgow), Ltd.,** has acquired new premises at 37-39, Blandford Street, Newcastle-on-Tyne (telephone: 23021). These will incorporate showrooms and trade counter, together with a stock covering radio and electrical appliances and accessories and domestic lighting fittings. Mr. F. Clark, formerly assistant manager at the Aberdeen branch, has been appointed branch manager.

B.M.B. (Sales), Ltd., High Street, Crawley, Sussex, announce that they are now the sole selling agents for **S.B.W. (Coldheading), Ltd.,** manufacturers of rivets and pins for the radio and electronics industry, aircraft construction and instruments.

The **Sturdy Electric Co., Ltd.,** has transferred its works and offices to Sturdy Works, Hamsterley Colliery, Newcastle - upon - Tyne (telephone: Ebchester 271). The new works will enable the company's range of transformers to be extended, and will incorporate a separate section specially equipped for the manufacture of portable and other types of transformers, from 50 VA to 2 kVA.

Acrow (Engineers), Ltd., South Wharf, Paddington, London, W.2, have been appointed sole agents in the United Kingdom for Demag electric hoists and cranes.

Bill Switchgear, Ltd., has acquired larger premises for its Glasgow branch office and stores at 20, Sandyford Place, Sauchiehall Street, Glasgow, C.3 (telephone: Central 0960). Mr. J. D. Harris is the manager of the branch. As from 1st August the London branch office will be at Gillingham House, 38-40, Gillingham Street, Victoria, London, S.W.1 (telephone: Tate Gallery 0871).

Warmur Rugs, Ltd., has transferred the manufacture and selling organisation of its "Mar-Tex" electric blankets to its associated company, F. Marshall (Textiles), Ltd., Hollins Mill, Marsh, Huddersfield (telephone: Huddersfield 2949).

Flameproof Apparatus

General Requirements and Design Considerations

By J. W. L. ANDERSON, B.Sc., and H. J. CARTER*

ELECTRICAL equipment installed in coal mines where danger from firedamp may arise must be of flameproof construction and must comply with designs which have been proved by test to be safe and have been duly certified as flameproof (often contracted to FLP). B.S. 229 defines a flameproof enclosure for electrical apparatus as "one that will withstand, without injury, any explosion of the prescribed inflammable gas that may occur within it under practical conditions of operation within the rating of the apparatus (and recognised overloads, if any, associated therewith), and will prevent the transmission of flame such as will ignite the prescribed inflammable gas which may be present in the surrounding atmosphere." The specification prescribes those features of design and construction which are considered essential or desirable to secure reliability in service.

The various inflammable gases and vapours which constitute an explosion hazard in industry are placed in four groups according to the maximum permissible dimensions of joint gaps and other openings in the enclosure of the apparatus.

Apparatus for use in coal mines must satisfy the requirements of Group I (Methane). For example, for apparatus normally filled with air, the gaps between the joint surfaces and diametral clearances for operating rods and spindles is fixed at 0·02in maximum. In the same way, the diametral clearance for shaft glands of motors and generators other than labyrinth glands is 0·02in maximum. Again, in the case of Group I where the apparatus normally contains hydrocarbon oil and in other parts of the apparatus in gaseous communication with the oil, the gaps between joint surfaces and the diametral clearance for operating rods and spindles is restricted to a maximum of 0·006in.

The minimum breadth of all joints and the length of the flameproof path through or across any joint surface is indicated in the specification, the dimensions varying according to the volume of the empty casing and the nature of the apparatus in question. An indication as to the structure and relevant flameproof dimensions of a typical auxiliary switch unit complying with requirements in Group I is shown in Fig. 1.

When new designs of switchgear and motors are being considered by a manufacturer, all the relevant requirements of B.S. 229 and the appropriate B.S. electrical specification must be borne in mind so that the design shall fulfil the required conditions in every respect. On completion, the design is submitted to the recognised testing authority (the Ministry of Fuel and Power) for approval and the general procedure is briefly as follows. The flameproof certification drawings having been approved, a sample of the apparatus concerned is constructed by the manufacturer and is sent to the testing station for a type test. Examination is first made at the testing station to see that the equipment agrees with the constructional details which have already been approved by scrutiny of the drawings. If all is satisfactory the tests may then proceed.

Flameproof Test

The tests are not carried out with the apparatus under load as it is assumed that the applicant accepts full responsibility for its electrical performance without damage to the enclosure. Unless otherwise arranged, the apparatus is tested with all its electrical and mechanical components assembled for use.

For test purposes the interior of the apparatus is completely filled with the appropriate gas mixed with air to give the most explosive mixture, while the gas/air mixture surrounding the apparatus is that which is most

* The authors are with British Jeffrey-Diamond, Ltd.

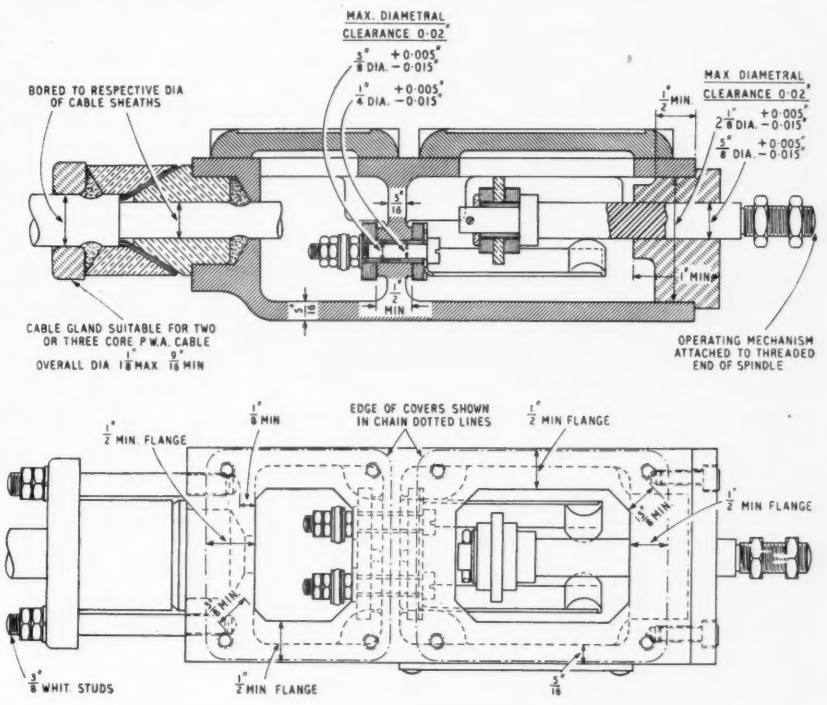

MAX. DIAMETRAL CLEARANCE 0·02"
BORED TO RESPECTIVE DIA OF CABLE SHEATHS
MAX. DIAMETRAL CLEARANCE 0·02"
CABLE GLAND SUITABLE FOR TWO OR THREE CORE P.W.A. CABLE
OVERALL DIA MAX MIN
OPERATING MECHANISM ATTACHED TO THREADED END OF SPINDLE
EDGE OF COVERS SHOWN IN CHAIN DOTTED LINES
1/2" MIN. FLANGE
1/2" MIN FLANGE
3/8" WHIT. STUDS
1/2" MIN FLANGE
5/16"

Fig. 1.—Typical of auxiliary switch unit complying with requirements in Group I

readily ignited by flame. In the case of rotary apparatus, inflammable gas is circulated through the enclosure by means of a fan.

The explosive atmosphere in the enclosure is ignited by an electric spark and the apparatus is considered to have failed to pass the test if the structure suffers injury or shows evidence of distress by reason of the pressure developed by the explosion, or if the inflammable gas surrounding it is ignited. Four tests are generally made, the first two being of a preliminary nature for the purpose of observation. In these tests, the enclosure is filled with, but is not surrounded by, inflammable gas.

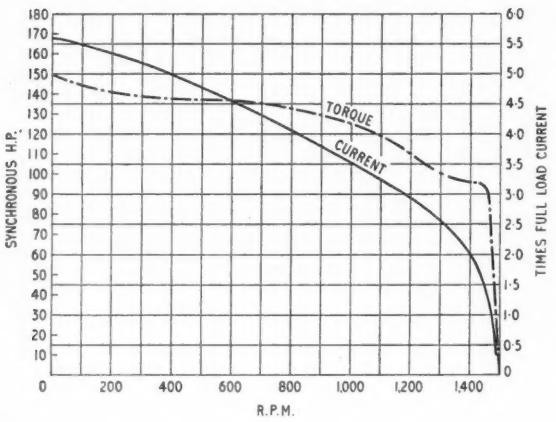
When equipment has passed the test, a flameproof certificate is issued to the manufacturer which covers the apparatus exactly as submitted for test. The certificate lists all the flameproof certification drawings submitted by the manufacturer. Equipment manufactured to this identical specification may then be permanently marked to show that it has been made in accordance with the approved and tested flameproof design. Such markings may be achieved either by raised lettering cast integral with the body of the apparatus or by a plate attached to the body of the apparatus in such a way that the flameproof enclosure is not affected. The marking must indicate the name of the manufacturer and must give the name and number, if any, by which the type is identified on the certificate. The registered flameproof mark must be reproduced (the letters FLP within the outline of a crown), also the number of the flameproof certificate and the group of gases and vapours which are covered thereby.

Once the flameproof certificate has been granted, no constructional alterations may be made to the design by the manufacturer without full approval of the testing authority. No alterations in constructional detail may be made by the user at any time.

If the manufacturer wishes to make small changes in the design, following experience in the field, it is necessary for a flameproof certification drawing, showing full details of the alteration proposed, to be submitted to the testing authorities for their approval and certification. Such procedure may usually be carried through without the necessity of a further type test. The document issued in these cases takes the form of a supplementary certificate.

Care needs to be taken in the assembling of FLP units in order to ensure that the validity of the certificate is not impaired. For example, a certificate covering an electric motor made by A, might cover the use of cable plug adaptors made by A or B, but would not necessarily cover a flameproof adaptor made by C although it might appear to be electrically and mechanically similar.

Fig. 2.—Characteristics of 60 h.p. coal cutter motor



Flameproof motors are covered by B.S. 741, a perusal of which is recommended. The specification applies to motors, the windings of which are insulated with Class "A" or Class "B" insulation and are wound for voltages not exceeding 650 V.

Cotton, silk, paper, and similar organic materials which have been impregnated or immersed in oil are included in Class "A" insulation. Enamelled wire also comes within this category. Class "B" insulation covers mica, asbestos, and similar inorganic materials in built-up form combined with binding cement.

The standard ratings specified in B.S. 741 cover motors operating under conditions where the temperature of the cooling air does not exceed 40 deg C. An indication of the limits of permissible temperature rise where motors are tested under rated conditions and in accordance with the requirements of the specification is given below:—

Part	Class "A" Insulation deg C rise	Class "B" Insulation deg C rise
Windings and cores with which they are in contact	50	65
Commutators	55	65
Slip rings	55	65
Uninsulated parts including cores not in contact with insulated windings.	The temperature rise shall in no case reach such a value that there is risk of injury to any insulating material on adjacent parts.	

For coal face duty, squirrel cage motors are almost universal. Provided the supply conditions are satisfactory in the case of gate and trunk conveyors operating on medium voltage, direct-on starting may be used for motors up to 75 h.p. Double-cage rotors may, with advantage, be fitted when direct-on-line switching is employed as starting currents may thereby be reduced to the minimum.

When a motor is not subject to the full cooling effect of the mine ventilation (as, for example, in the case of motors mounted "in line") the use of Class "B" insulation is generally to be preferred. Mush winding may be used but preformed hot-pressed coils are to be preferred where heavy overload may be anticipated. For heavy duty conveyors, remote from the coal face, high voltage motors are becoming increasingly popular.

The starting torque of motors used for mining equipment should generally be at least twice the full load torque as such units have frequently to start up under fully loaded conditions. In this connection, the torque/speed and current/speed characteristics of a 60 h.p. coal cutter motor may be of interest (see Fig. 2).

Motors associated with underground equipment have generally to operate under very arduous conditions and it is important that the h.p. and rating should be fully adequate for the duties which they have to perform. Conveyor motors should normally be continuously rated, whereas in the case of coal cutter motors it has been the practice to adopt a one-hour rating. Owing, however, to the growing trend towards continuous mining systems, the question of increasing the rating of coal cutter motors is receiving attention. B.S. 741 defines the rating of a motor as "a statement of operating limitations assigned to it by the maker."

The manufacture of flameproof apparatus does not present any particular problem to a works which normally

produces a high quality product but it is nevertheless essential that the machine operators and fitters should be aware when the components they are making form part of, or are associated with, a flameproof enclosure. For example, every detailed drawing which is concerned with FLP requirements should be stamped to draw attention to the fact. This is particularly necessary when the factory production comprises mixed components, some of which will be used for building into flameproof apparatus, whilst others may be used only for mechanical equipment.

Careful inspection of parts required for flameproof equipment is necessary, and from this aspect also, drawings should be suitably marked so that the works inspectors are fully aware of the position. When the time comes to assemble the flameproof equipment, it is necessary for copies of all relevant certification drawings to be available to those persons who are responsible for the assembly, to ensure that the finished product is in accordance with the certified arrangement. On assembly, gaps at all flanges and spindles should be examined to ensure that all requirements are complied with.

It is usual for flameproof enclosures to be pressure tested either by hydraulic or pneumatic means, the choice depending upon which system may be most convenient for the manufacturer in question. This test is to ensure that the apparatus is of sound construction, the pressure being applied for a period of one minute. This procedure is of particular importance when welded steel structures are concerned. The recognised testing authority may, in some cases, release the manufacturers entirely from the obligation of making a pressure test or, alternatively, it may be specified that tests should be made upon a proportion of the product manufactured, this being dependent upon the nature of the structure.

Gas-Tight Isolating Dampers

TO eliminate the large residual leakage which is associated with the conventional flue damper in large water tube boilers the Metropolitan Engineering Co., Ltd., has developed a damper which, when closed, provides gas-tight sealing of the flue. By using this type of damper the boiler is prevented from cooling down during periodical shut-downs and the unproductive fuel consumption which would otherwise be necessary to replace the lost heat, is saved.

The damper also prevents damage to the boiler, thereby increasing plant availability. It does this by eliminating some of the main causes of plant failure, such as thermal fatigue caused by repeated cooling shocks from the impact of cold air on hot boiler parts, or by reducing the risk of corrosion due to acid condensation on air pre-heaters and other parts, or by preventing gas back-flow into the boiler during standby periods from main flues under positive pressure. This reduces the need for many of the enforced boiler stoppages which have become a major factor in power station economy due to their high cost; the outage of a 60 MW station, for instance, represents a loss of about £6,000 a day.

Gas-tight isolating shutter for Little Barford power station

When we visited the company's works last week we saw a 16ft by 8ft 6in "Metro-flex" sealing unit for the outlet flue of one of the boilers at Little Barford "B" power station of the Eastern Division of the Central Electricity Authority. The unit comprises a type of roller shutter which employs a leaf spring sealing system for achieving a gas-tight closure. The sealing elements are incorporated into an all-metal roller curtain with cross-reinforced members and are flexed and tensioned when the roller shutter moves into its closed position. They accommodate easily any warpage or mis-alignment which might take place in ducts and frame during service. The curtain is supported by vertical members which take up the differential pressure load and those near the outer edge serve additionally as deflectors and tensioners for the leaf spring sealing system.

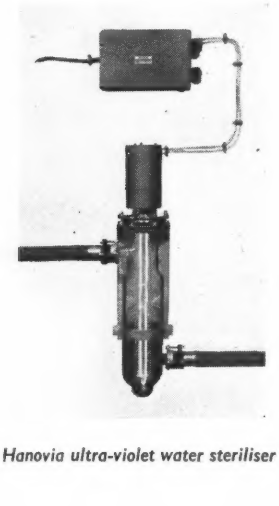
The company also makes hinged flap type dampers of all sizes incorporating the leaf spring sealing system and there is no doubt that their use results in both a reduction in fuel costs and maintenance bills. A more recent development is large gas-tight valves for use in coolant circuits of Calder Hall type nuclear reactors. These are similar to the Little Barford outlet flue dampers and are likely to be much more effective than the wedge gate type valves hitherto employed.

Installations in Ships

A NEW and comprehensive code of practice dealing with electrical installations in ships has just been published by the International Electrotechnical Commission (I.E.C. publication 92). This code, which was completed last month by a representative I.E.C. Committee meeting at Rapallo, Italy, is intended eventually to replace the several sets of rules and regulations imposed by different countries. These differences ignore the facts that ship-board operating conditions, the materials used in electrical equipment and the characteristics of electrical circuits are similar and subject to the same natural laws in every country.

The attempt by I.E.C. to alleviate this situation started before the war and then had to be abandoned. In 1948, however, immediately following the Convention on Safety of Life at Sea, the effort was renewed under the chairmanship of Mr. G. O. Watson, Principal Electrical Engineering Surveyor, Lloyd's Register of Shipping. The new code deals with every aspect of the electrical equipment of ships and should be of value to shipbuilders, electrical contractors and manufacturers.

NEW ELECTRICAL EQUIPMENT



Hanovia ultra-violet water steriliser

Jackson "Jill" 1½ gal water heater

Metrovick type RIO/2 infra-red oven

Water Steriliser

A dual-purpose ultra-violet water steriliser has been introduced by the HANOVIA LAMPS DIVISION of Engelhard Industries, Ltd., Slough, Bucks, which will treat up to 400 gal of water per hour as a continual flow unit. The lamp assembly can be quickly detached from the outer chamber and used separately as an immersion steriliser for water tanks. For static tanks of, for example, 50-100 gal capacity, the immersion unit will deal with a demand of about 300-400 gal per day.

The unit has a length, including terminal box, of about 27in, and incorporates a 44 W l.p. mercury vapour discharge tube in clear quartz, made in U-form to fit inside a clear quartz envelope. The loading is 150 W. The ultra-violet lamp has a normal effective life of 2,500-3,000 hours after which it may continue to operate for several thousand hours at a reduced u.v. output.

This model 6 immersion type water steriliser costs £52, a conversion set for continuous flow applications costing £23 15s. Spare or replacement u.v. tubes can be supplied for £15 15s.

Water Heaters

The two new "Jill" storage water heaters recently introduced by the JACKSON ELECTRIC STOVE CO., LTD., Dallow Road, Luton, Beds, have been designed to facilitate maintenance, the base cover and apparatus plate being simply removed, giving access to all component parts. They are in two sizes, 1½ and 3 gal, with a choice of coloured finishes—all white, all cream or with turquoise blue or eau-de-nil base covers. A 9in swivel outlet pipe is supplied as standard, and 12 or 15in to special order at extra cost. The standard loadings are ¾ kW (1½ gal) and 1 kW (3 gal). There are also optional loadings of 1 kW and 2 kW respectively. Both heaters employ a simple three point fixing with rubber seal for flush fitting to the wall. They measure 9⅛in wide by 9½in deep and the heights are 14⅛in (1½ gal) and 22⅝in (3 gal). They are priced at £10 5s and £11, plus £4 16s and £5 3s respectively for purchase tax in the United Kingdom.

Infra-Red Oven

A new infra-red oven has been specially designed by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, 17, for the heating of small articles and materials in batch production. It is also suitable for pre-heating, paint stoving, drying of lacquer, and curing and softening plastics, etc. This type IRO/2 oven has a sheet steel casing housing infra-red tubular sheathed heating elements in anodised aluminium reflector troughs in the top of the oven which heat the material on a shelf by direct radiation.

The oven is ventilated through louvres in the top cover with air intake vents in the base raised clear of the bench by means of small feet. An asbestos tray, wire mesh tray, hinged front door, floor mounting stand and energy regulator control box can be supplied at a small extra cost.

For lower intensities of radiant heat and for infinitely variable fine control, a Sunvic energy regulator scaled 0/100 can be provided for separate mounting. It incorporates a type ERL energy regulator, a 30 A special contactor, and red and white indicator lamps mounted in a sheet steel box. The standard IRO/2 oven is rated at 6 kW nominal, and is suitable for use on 400/440 V three-phase or 230/250 V single-phase.

Flameproof Motors

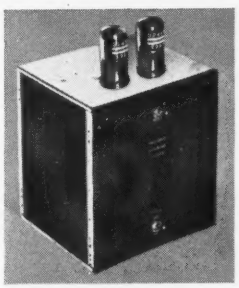
A new range of steel barrel type flameproof motors has been developed by the ENGLISH ELECTRIC CO., LTD., Bradford, for mining and other applications calling for mechanically robust flameproof machines. They are available as straight totally-enclosed or as totally-enclosed fan-cooled machines. The totally-enclosed type can be supplied for outputs from 5 h.p. at 4-pole speed and are also available for 6- and 8-pole outputs. The totally-enclosed fan cooled machines are fitted with a fan and cowl of anti-sparking material and can be supplied for outputs from 33 h.p. at 4-pole speed and are also available for 6- and 8-pole outputs. Both types can be provided for any supply up to 650 V.

These motors are designed to give high starting torque with low starting current and are capable of developing 2¼ full load torque with five times full load current when started direct on the line.

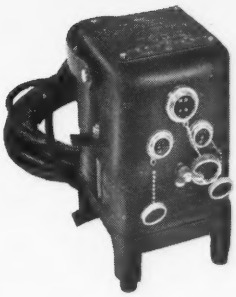
High Speed Electronic Counter

A counter unit has been produced by MILLETT, LEVENS (INSTRUMENTS & ENGINEERING), LTD., Whadcoat Street, Finsbury Park, London, N.4, with a counting rate up to 30 kc/s, which occupies little space and has a low energy consumption and built-in visual indication. The model illustrated is capable of counting up to 99, but any number can be indicated by adding further tubes, the first tube counting units, the second tens, the third hundreds and so on. The only controls on the front panel are the mains on/off switch and a "reset" switch; the latter, which could be arranged to be automatic after a given count, resets all tubes to zero after the maximum count has been recorded.

The unit can be employed to count at very much slower rates, while in



High-speed electronic counter



Ferranti 750 VA 230/240 V 50 c/s transformer

conjunction with the company's electronic timer, a complex process control system could be devised.

"Static" Variable-Voltage Lifts

An improved type of variable-voltage drive for lifts, claimed to offer certain advantages over what has been hitherto obtainable, is now being installed by WM. WADSWORTH & SONS, LTD., Bolton. The two main features of the new system are the replacement of the motor-generator set by an electronically-controlled mercury-arc rectifier and the stepless control of the speed of the lift according to its own motion in the shaft, rather than by timing devices or control motors. This technique has been made possible largely by the superior control characteristics of a static rectifier.

The lifts give smooth, even acceleration, and precise approach to the floor. The ability of a rectifier to supply large currents at reduced voltage permits a wide speed range to be used and stopping is exceptionally accurate. On a typical installation the maximum variation with any load in either direction is $\frac{1}{8}$in, whilst tests are on record in which no measurable variation could be detected.

The static rectifier can be shut down completely from the control circuit, so that nowhere in the control gear are heavy currents interrupted, and contact duty is extremely light, a feature particularly attractive for higher h.p. drives. Delivery of this type of drive is favourable, as the motor and rectifier are standard patterns. Another point is that builders' work for installation is reduced.

Small Portable Transformers

A range of transformers has recently been produced by FERRANTI, LTD., Transformer Division, Edinburgh, which are suitable for industrial portable tools in view of the saving in weight which in some instances may amount to 50 per cent. The winding is encapsulated in epoxy resin and the C-core of cold rolled oriented silicon steel is clamped externally, the whole being assembled in an aluminium alloy casing. Cartridge type fuses fitted beneath a cover are rated for the full load of the secondary output.

The transformers are designed to be damp-proof and will operate out of doors under all climatic conditions. The ratings are 50 VA, 300 VA, 500 VA and 750 VA, the weight of the smallest being 12 lb and of the largest 24 lb. The detailed electrical specification of a 750 VA transformer is as follows: Primary, 230/240 V 50 c/s with earth screen between primary and secondary; secondary 1: 115 V centre-tapped 700 VA; secondary 2: 24 V 50 VA; temperature rise, 53 deg C; watt loss, 10 W maximum; efficiency, 95 per cent minimum; regulation, 6·5 per cent maximum.

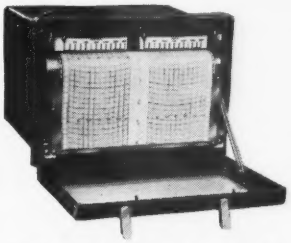
Plastic Tubing

"Deltathene" high tensile polythene, which has been available since B.S. 1972 was drafted in 1952, is claimed to possess twice the strength of "conventional" polythene. It is manufactured by F. H. BOURNER & Co. (ENGINEERS), LTD., Manor Royal, Crawley, Sussex, and it can be extruded through a range of internal diameters from $\frac{1}{2}$in to 4in. The material is waterproof, resistant to a wide range of acids, alkalis and aqueous solutions and, being a thermo-softening plastic, it is easily manipulated in the flame of a blowlamp.

The electrical properties are as follows:—Resistance 10^{18} ohms/cm; surface resistance greater than 10^{12} ohms/cm; breakdown voltage 50 kV/mm; and dielectric constant 2·2. Resistance to tracking is good.

Duplex Graphic Recorder

Where two quantities are related in some way to each other it is often a great convenience to be able to reproduce them side by side on a common chart. An instrument manufactured by the RECORD ELECTRICAL CO., LTD., Broadheath, Altrincham, Cheshire, consists of two recorder movements mounted side by side in a common case with a common chart mechanism. At present a flush pattern only is available, the case being approximately twice the width but equal in height and depth to the single recorder. The chart width is approximately 8in overall, each movement operating in a 3in ruling. In addition there is a $\frac{1}{4}$in wide track down each side of the chart so that one or two marker pens may be added if required. Each chart is 65ft long, giving a month's record at 1in per hour.



The Record duplex graphic recorder

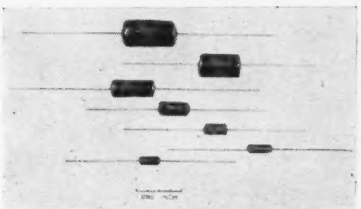
The chart mechanism is driven by a synchronous motor and has speed change giving a choice of any two speeds per hour or per minute between $\frac{1}{2}$in and 12in. The mechanism is easily removable for renewal of the chart and can be supplied for 100/125, 200/250 or 380/440 V, 50 or 60 c/s. A mechanical chart drive will be available in due course as an alternative. All the features of the single recorder are equally applicable to the duplex model.

Paper Capacitors

A new series of paper capacitors known as the "Plesmin" range is being produced by the PLESSEY CO., LTD., Ilford, Essex, in small sizes and with a high standard of performance. The smallest measures only $\frac{3}{8}$in long and $\frac{1}{8}$in in diameter and the largest $1\frac{1}{4}$in long and $\frac{1}{2}\frac{3}{2}$in in diameter. The range extends from 0·001 μF up to 1·0 μF, with a normal tolerance of ± 20 per cent for 0·01 μF and above, but below this the normal tolerance is ± 25 per cent.

Voltages normally covered by "Plesmin" capacitors are 12, 25, 50 and 100 V but they can be obtained for working voltages up to 150 V d.c. if ordered specially. An insulation resistance of 1,000 ohms-farad minimum at 20 deg C at the rated d.c. working voltage can be obtained. Now that these paper capacitors of lower working voltages are available, the practice of using capacitors where the rated voltage was not approached even under fault conditions can be eliminated. Features of particular interest to designers are the reduced size and low inductance values of the capacitors which are of full tropical finish. Moreover, like metallised paper capacitors, they have self-healing properties if circuit parameters are suitable.

Part of the Plessey range of "Plesmin" paper capacitors



Argentine Power Shortage

THE new Argentine Minister of the Treasury announces that capital goods and accessories will be imported through the free market in future and that foreign credit facilities will be used as far as possible to make up for the shortage of exchange. Total imports amounted, in value, to the equivalent of U.S.$1,123 million last year, of which U.S.$150 million represented free market imports. On this basis, despite the recent transfer of many goods from the official market, a very considerable part of the urgently-needed industrial machinery and electrical equipment will have to be financed by overseas credits or investments.

Nationalist opposition has hitherto prevented the Government from having recourse to available sources of foreign capital to increase power plant capacity. An investment of U.S.$90 million in a new power station, offered by the American and Foreign Power Co., was turned down and successive proposals to seek the collaboration of the foreign-owned supply companies, CADE and ITALO, were abandoned. The Press and the public have now revolted, however, and the widespread reaction should strengthen the Government's hand.

In a joint memorandum addressed to the President of the Republic, the Industrial Union, Commercial Exchange and Rural Society pledges support to the Government in any action it may take to secure the speedy solution of the power problem.

The memorandum points out that present power cuts have reduced industrial activity by 9 per cent and will become more severe later in the year, involving enterprises in Greater Buenos Aires, alone, in a loss of over 30,000 million cruzeiros in 1957 and causing unemployment. Consumer needs are growing at the rate of 250 MW every four years and the additional supply from the San Nicolas station, available late in 1957 or early in 1958, will afford only temporary relief. By 1960 there will again be a deficit of 650 MW. The 600 MW South Dock station, for which tenders have been invited, will take four to seven years to complete, while the long-term Salto Grande, Apipe and Parana hydro-electric projects are still under study. On the other hand, arrangements could be made to increase the capacity of existing stations and of the San Nicolas plant so as to give Buenos Aires an additional 700 MW in just over three years.

If these recommendations are carried out Compania Argentina de Electricidad will presumably revise its March decision to bring legal proceedings against the Federal Government and the Buenos Aires Municipality for non-fulfilment of contractual obligations regarding tariffs. The company's repeated requests for permission to adjust charges, as provided for in the contract, have been ignored. It has stated clearly that it will be impossible to meet new demands as long as the price of electricity is maintained at the same basic tariff as twenty years ago.

On this point some apposite remarks were recently made by Mr. Eugene Black, president of the International Bank for Reconstruction and Development, in an address to the Economic and Social Council of the United Nations, which have been reproduced in the Buenos Aires Press. Referring to the popular belief that cheap power was indispensable for rapid industrialisation, said: "I do not understand this argument. The industries which are to use the power are in the best position to pay for it. Power charges are a very small item in most industrial costs. On the other hand, if industries are subsidised through cheap power rates the burden for paying for power is merely shifted to other taxpayers. The power system itself finds it harder to obtain capital needed for expansion, with the result that industrialisation, far from being encouraged, is often actually obstructed. And the really expensive kilowatt is the kilowatt that an economy needs and does not have."

E.I.B.A. Annual Meeting

MR. HARRY RILEY presided at the annual meeting of the Electrical Industries Benevolent Association held at the C.M.A. offices, High Holborn, London, W.C.1, on Friday last. Mr. Riley said that he regretted to report that a deficit of £6,500 had been incurred last year. The reason was not a decline in income but the rapid growth of the Association's work in the rapidly-expanding electrical industry. He feared that in spite of the Association's appeals the income had not grown at the same rate as the industry. This year, to avoid a further deficit the E.I.B.A. would need not merely an extra £6,500 but the further amount which would be demanded by the expanding activities; he put the need at £15,500 more.

Mr. J. S. Pickles

In proposing the adoption of the report and accounts, Mr. C. R. King, chairman of the Court, assured members that the administration charges shown in the accounts covered a great deal more than office expenses. He was pleased to announce that the electricity supply industry had decided to raise its annual subscription from £9,000 to £12,000. There were too many 5s subscriptions still; those concerned should consider raising them to at least £1—and enter into a seven-year covenant to enable the Association to recover the income tax. Mr. King said that a small subcommittee had been formed to produce a settled plan for the Broome Park Home for old people to make a bigger thing of it. A personal appeal for funds was being made to the leaders of the large manufacturing concerns.

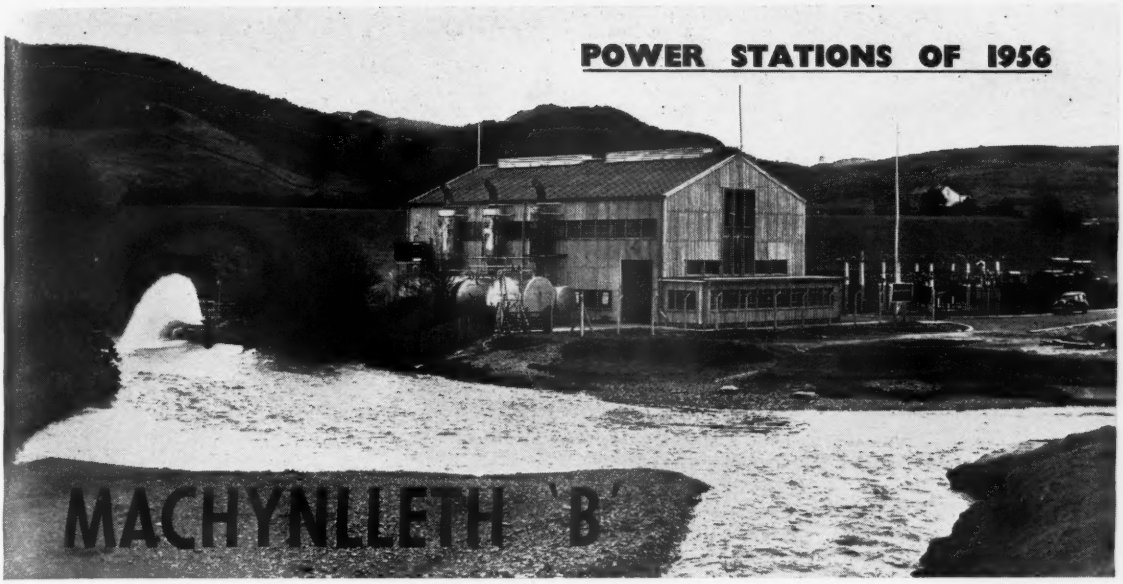
Mr. F. E. C. Miller, chairman, Finance Committee, seconded the motion and referred to particular items in the accounts. He said that the amount disbursed in grants, pensions, etc., had risen by over £9,000 or 20 per cent. The cost of running the Association had not grown at anything like the rate at which general costs had risen. Mr. Miller said that the staff was still inadequate and grossly overworked; it must be increased—with people of the right calibre.

After the annual meeting there was a Council meeting at which Mr. J. S. Pickles (chairman, South of Scotland Board) was inducted into the presidency as successor to Mr. Riley. Mr. Pickles spoke appreciatively of Mr. Riley's work during his term of office. The members of the Council were re-elected with the exception of Sir Hugh Warren, and Mr. Riley and Viscount Chandos were elected additional members.

At a subsequent meeting of the Court Mr. King was re-elected chairman.

LOW TEMPERATURE HEATERS

In the next of our illustrated surveys of domestic electrical appliances (26th July) we shall be dealing with low temperature heaters. Particulars, given in tabular form, will include details of type, size, method of control, casing, loading, finish, price, purchase tax, etc. The subject of the following survey (16th August) will be blankets and pads



THREE 1·33 MW DIESEL SETS IN COMMISSION

BEFORE the electricity supply industry was nationalised in 1948 the Machynlleth Electric Supply Company operated a small diesel and hydro-electric power station of 500 kW installed capacity, which was sufficient to meet local requirements at that time. After nationalisation it was anticipated that the demand of the whole of the Mid-Wales area, covering some hundreds of square miles, would require the interconnection of Machynlleth, Aberystwyth, Towyn, and Dolgelley generating stations. These were successfully operated as a group until 1954, when, due to rural electrification development, it was found necessary to augment the supply by a 33 kV connection from Maentwrog power station about 40 miles to the north.

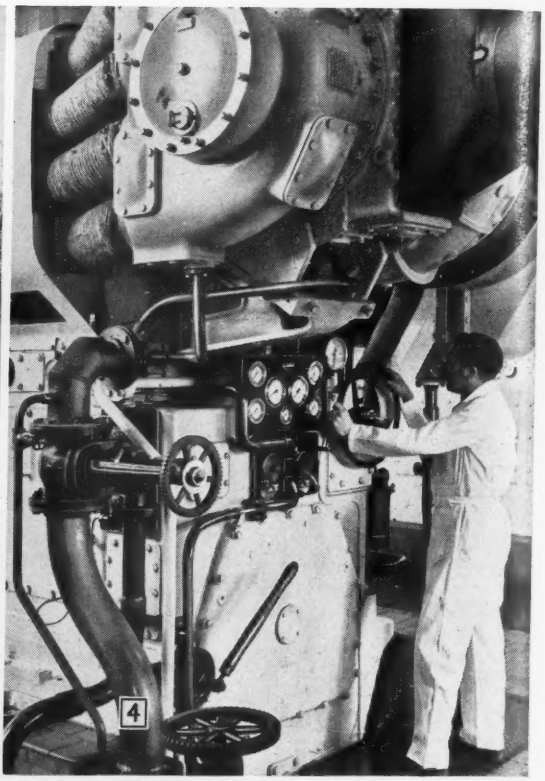
Continued load building in the area has required the construction of a further diesel power station at Machynlleth which, with an installed capacity of 4·25 MW, should meet the demand until the 50 MW Rheidol hydro-electric scheme is completed in the Plynlimmon Mountains. The site of the new power station is at Felingerrig about a mile to the west of Machynlleth, Montgomeryshire, on the south side of the main road from Machynlleth to Newton, immediately before Pont-Felingerrig. The site was chosen because of its proximity to the Area Board's new 33 kV substation and to a source of suitable cooling water, the Afon Dulas.

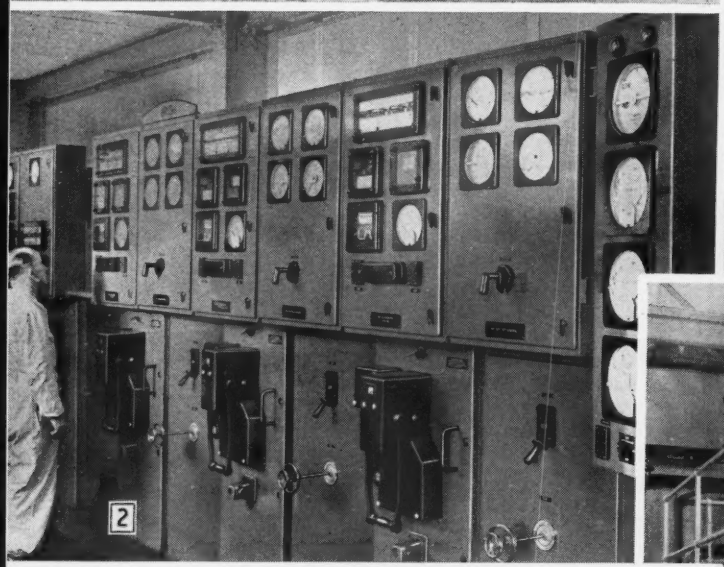
The station building is of welded steel, portal frame construction with asbestos sheet cladding; the overall dimensions are 96ft by 60ft wide, by 40ft high. The building houses three diesel generator sets, switchgear and ancillary plant with stores, office and mess room accommodation. Provision has been made for the installation of a further small diesel set at present installed in the "A" station.

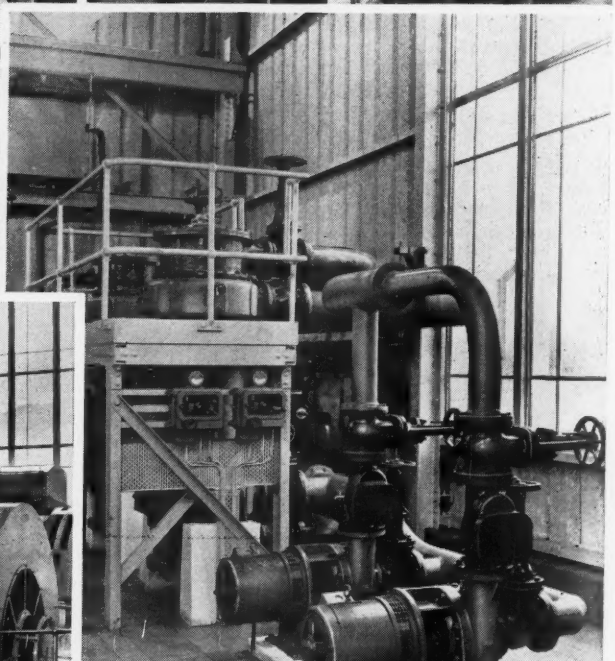
Each generating set comprises a Mirrlees, Bickerton & Day, Ltd., eight-cylinder pressure charged diesel engine rated at 1,930 b.h.p. at 428 r.p.m., direct coupled to a 1·33 MW Brush alternator. This engine is the well-known type KSS, which operates on the four-stroke principle with open type combustion chambers and direct fuel injection.

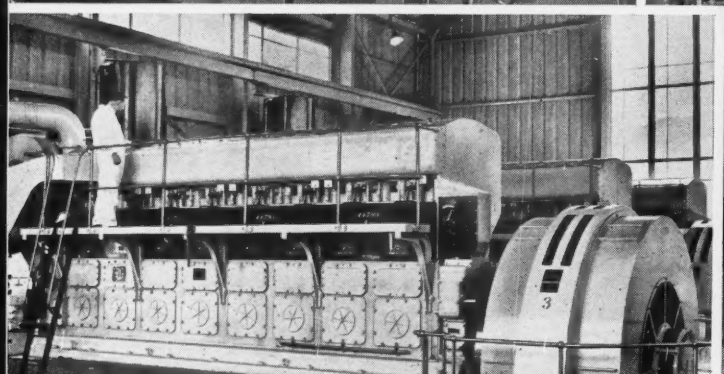
The fuel injection pumps and atomisers are of Bryce manufacture, each cylinder having its own pump which can be adjusted independently of the others. The pumps are mounted at the top of the crankcase and the bottom of each cylinder to minimise the length of pipework between pumps and injectors. The fuel oil passes from the daily service tank (300 gal capacity) through a gauze filter in

The station accommodates three 1·33 MW diesel alternator sets









1. *Secondary cooling water is discharged back to the river through this spray arrangement.* **2.** *The generators are controlled and synchronised from this panel.* **3.** *Each engine is directly coupled to a 1·33 MW alternator.* **4.** *Starting is simple as it involves only the operation of a single hand-wheel.* **5.** *Heat exchangers and c.w. pumps*

the tank itself and subsequently through a duplex filter on the engine. A feature of these filters is that they can be changed while the engines are running.

The governor controlling the fuel pumps is of the centrifugal type and it is mounted at the flywheel end of the engine. It is gear driven from the crankshaft and can be adjusted to give speed control between 5 per cent above and 10 per cent below the normal engine speed. An emergency governor is also fitted to provide protection against overspeed, and it is set to operate at about 15 per cent above normal running speed. The engine is also arranged to shut down automatically should there be a failure in lubricating oil pressure. Audible and visual alarms are provided for high lubricating oil and cooling water temperatures and low cooling water flow. Each engine is also fitted with a Brown Boveri exhaust gas driven turbo charger together with an inter-cooler to lower the temperature of the air after it has passed through the superheaters.

Cooling Water Systems

Each engine has both primary and secondary cooling water systems. The primary system circulates treated water through the engine jackets and this circuit is cooled by the use of secondary water in a heat exchanger. Primary water leaves the engines at 140 deg F and is pumped through the heat exchangers where it is cooled to 120 deg F before again circulating through the engine jackets. The secondary water for the heat exchangers is drawn from the Afon Dulas and led through the engine oil coolers, etc., through the heat exchanger tubes and then returned to the river. The primary water circulates around the heat exchanger tubes.

As the Gwynedd Rivers Board stipulated that the discharge of cooling water to the Afon Dulas should not cause the temperature of any part of the river to rise higher than 70 deg F, the secondary water is discharged back into the river through a specially designed spray arrangement. The points of water intake and discharge have also been kept as close as practicable so that any tendency to denude the river of water shall be kept over as short a length as possible.

The advantage of the type of cooling system employed is that a much improved thermal gradient is obtainable across the engine jackets, resulting in improved running conditions and minimum difference between jacket inlet and outlet temperatures. Moreover, it is also possible to obtain much lower lubricating oil temperatures as the oil cooler is in the secondary circuit which is 30 to 40 deg F lower in temperature than the engine jacket system.

The engine is started by means of compressed air (300 lb/sq in nominal) through the master starting valve and patented timing valves and it can be instantly run up to full speed from cold. The starting procedure is simple as it involves only the operation of a single hand-wheel which has three positions: "start," "stop," and "run." The fuel consumption of each engine is 0·488 lb/kWh at full load and 0·532 lb/kWh at half load.

Two fuel oil storage tanks of the ex-Lancashire boiler type have been installed, providing for a total storage capacity of 18,000 gal, which is sufficient to run the station on a 50 per cent load factor for one week without any additional deliveries. At present the station is being run on Esso gas oil, but investigations are being made into the possibility of using a very much heavier grade of oil.

Each diesel engine is direct coupled to a 428 r.p.m. 1·33 MW 0·8 p.f. three-phase 6·6 kV alternator supplied by the Brush Electrical Engineering Co., Ltd. Each machine is fitted with a direct coupled overhung exciter. From each alternator cable connections are made to a Brush type VA5 eight-panel 6·6 kV switchboard. Six of the switches control the alternators while the other two control a 300 kVA station auxiliary transformer and the feeder to the 6 MVA 6·6/33 kV transformer in the 33 kV substation of the Merseyside and North Wales Electricity Board adjacent to the station. In this way each alternator is switched on to a common 6·6 kV busbar from which outgoing power is taken to the substation.

The generators are controlled from the eight-panel board which is situated in a soundproof control room on the west side of the engine room together with a synchronising panel which is common to the three 1·33 MW sets. The manually controlled field rheostats are also accommodated on these panels, together with indicating instruments, circuit-breakers and governor control switches, indicating lamps, and synchronising plug sockets.

Acknowledgment is due to Mr. A. R. Cooper, Divisional Controller, North West, Merseyside and North Wales Division, Central Electricity Authority, for permission to publish this article and to Mr. I. W. Williams, resident engineer, for his assistance in the preparation of the material.

Scottish Tariff Action

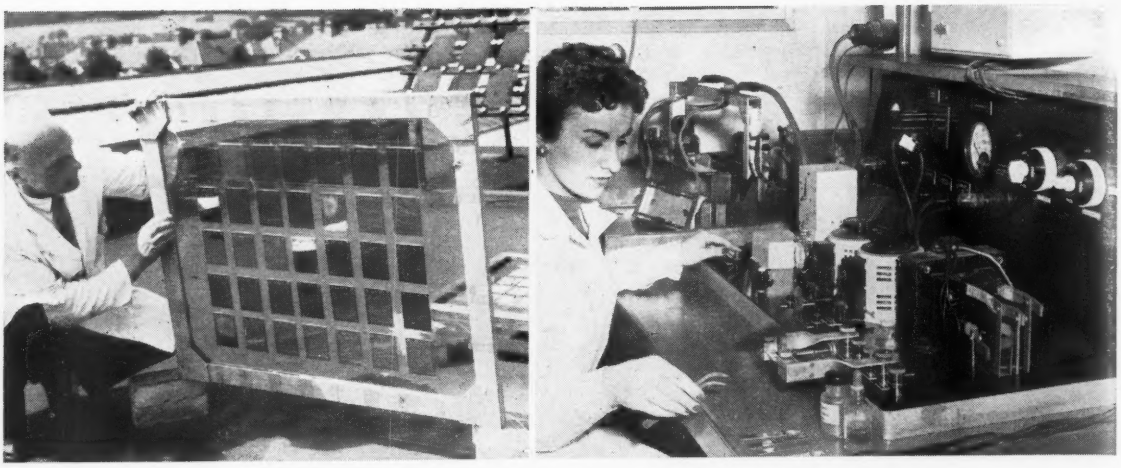
AN interim interdict was granted by Lord Walker in the Court of Session, Edinburgh, on 12th July against the South of Scotland Electricity Board to prevent it from charging British Oxygen Gases, Ltd., Hillington, Glasgow, for electricity under a tariff which, the company alleges, discriminates against it as a consumer of high-voltage supply.

Mr. I. H. Shearer, Q.C., representing British Oxygen Gases, Ltd., and the British Oxygen Co., Ltd., recalled that the latter company had asked Lord Hill Watson for a declaration that certain industrial demand tariffs showed undue discrimination against the high-voltage consumer. After Lord Hill Watson dismissed the action in December, 1954, the plaintiffs appealed to the Second Division of the Court of Session, who, in June, 1955, allowed a proof. On the Board appealing to the House of Lords, the House in 1956 held the case relevant and sent it back to the Court of Session for proof. The Board then amended its defence and certain fresh matter was admitted to the case. The result was that the action again came before Lord Hill Watson last May when the effect of his judgment was to allow a proof (see *Electrical Review*, 7th June, page 1058). That judgment was now under appeal.

Mr. Shearer said that Lord Hill Watson had held that, in view of certain fresh arguments presented to him, there was no relevant case stated which would permit the company, if it were subsequently successful in its action, to recover the amount of the overcharge. In effect, his Lordship had held that there was no way of measuring any overcharge. The premises in respect of which that action had been raised were now occupied by British Oxygen Gases, Ltd. This was a different company although a wholly owned subsidiary. The latter company had now raised an action of declarator and interdict against charges being made upon it on the basis of what it said was a bad tariff in the sense that it showed undue discrimination. If Lord Hill Watson were right, said Mr. Shearer, his clients would have to go on paying under the tariff, and if they proved it not to be in accordance with statutory regulations, they could not get their money back.

Opposing the granting of the interim interdict, Mr. R. D. Ireland, for the Board, said it was six weeks since the time of Lord Hill Watson's decision and he could not see the reason for the urgency for such a motion being put forward now.

Lord Walker said that in his opinion the balance of convenience and of equity was in favour of granting an interim interdict.



Left: Samples being prepared for atmospheric corrosion tests. Right: Testing metals for solderability

TIN RESEARCH

To celebrate its twenty-fifth anniversary, the Tin Research Institute arranged two "open days" last week for visitors to inspect its laboratories and meet the staff. The visitors included many well-known scientists and technologists and so far as was practicable, there were demonstrations of techniques which have been developed or are used at the Institute.

A noteworthy demonstration was the continuous casting of 1½in diameter bronze rods on a machine specially developed at the Institute. The cast rod is of a high quality and there is no wasted material. Essentially, the stream of liquid metal accumulates in a tun dish, situated in a gas heated jacket. From here, the liquid metal runs into a water-cooled mould and is withdrawn below as a solid rod. Motor car bearings and diesel engine bearings shown in the metallurgical laboratory were made from alloy of aluminium and tin, bonded to thin steel strip shells. The aluminium-tin alloy is prepared as a strip which is then welded to the flat steel strips and the composite material is specially formed into half-shells and accurately machined to fit the engine shafts.

Continuous casting of bronze rods of 1·5in diameter

Studies in corrosion form a big part of the Institute's work, because so much of the world's tin is consumed as corrosion protecting coating for steel in the form of tinplate, upon which the canned food industry is dependent. Demonstrations were given of the improved techniques which have been developed for applying tin coatings to cast iron mincers and to steel milk churns.

Electroplating studies at the Institute have led to the development of methods for laying down alloys of tin with other metals as protective or decorative coatings. Among the pairs of metals which can be deposited as alloy in this way are tin-copper, tin-zinc, tin-cadmium, and tin-nickel. The tin-nickel electroplate retains a brilliant polish and is now being used for the bright parts of scientific instruments. The greatest interest, however, was shown in the newly announced "bright tin" plating, for by this method, coatings which have a brightly polished appearance can be applied to steel, copper, brass, etc. The new "bright tin" is therefore potentially an enormous labour-saving process.

Fungicides based on tin chemicals were also shown. These chemicals are known as organotin compounds and their feature is that each atom of tin is chemically bonded to three atoms of carbon. These compounds are among the most powerful fungicides known and they are now being adopted in paper and pulp industries, wood preservation and water treatment, and it is considered likely that there can be a considerable future for them in agriculture as pesticides and weed killers.

The Tin Research Institute's sponsors are the tin producers in the Belgian Congo, Bolivia, France, Indonesia, Malaya and Nigeria. All the services and publications of the Institute are available free of charge from the Institute in London, and from its eight offices in countries overseas.

Atomic Energy in Isolated Regions

GENERATION IN UNDER-DEVELOPED COUNTRIES DISCUSSED AT BELGRADE

SURVEYING papers relating to the prospects of nuclear generation in countries at present under-developed, Mr. J. C. Duckworth (Central Electricity Authority) reported to the recent World Power Conference that he found no general agreement regarding the reactor types that were likely to capture the market.

In determining the economic factors, which should predominate, the first need was to assess a practical rate of progress in a country's general level of industry, and then to consider what conventional power sources were available, the cost of putting them into service and the probable trend of fuel prices.

A number of manufacturers could quote firm prices for such reactors as were out of the experimental stage. The present high capital cost of nuclear plants placed them at a disadvantage at the low load factors to be expected in non-industrial countries and their ability to cope with daily load fluctuations was still doubtful. Furthermore, the cost per kW rose steeply with reduction in size of reactor. Nuclear training of operating staff would not be required before commitment to a project, but a preliminary need would be to build up a technical staff with experience in general engineering.

Mr. J. A. Jukes (United Kingdom Atomic Energy Authority) set out in Tables 1 and 2, here reproduced, typical comparisons between alternative base-load power stations in the United Kingdom at the present time. He expected the capital cost per kW of the second group of graphite-moderated gas-cooled natural-uranium reactors of the C.E.A. stations (the contracts for which would be signed within the next 18 months or so) to be possibly 15 per cent lower. A 50 MW reactor might cost 50 per cent more.

TABLE 1.—COMPARISON OF COSTS OF GENERATING ELECTRICITY

	Pence per kWh sent out		
	Nuclear	Coal Fired	Diesel
Capital charges	0·40	0·13	0·09
Initial fuel charge	0·05	—	—
Works costs	0·05	0·05	0·04
Fuel costs	0·22	0·42	0·74
Gross generating costs	0·72	0·60	0·87
Less plutonium credit	0·06	—	—
Net generating costs	0·66	0·60	0·87

TABLE 2.—DESCRIPTION OF STATIONS AND ASSUMPTIONS ON PERFORMANCE

	Nuclear	Coal Fired	Diesel
Output	300 MW s.o.	200 MW s.o.	10 MW s.o.
Capital cost per kW s.o.	£135	£55	£36
Thermal efficiency, per cent	27	34	—
Load factor, per cent	75	75	75
Life of plant, years	20	27½	25
Rate of interest, per cent	5	5	5
Initial fuel charge	500 tons	—	—
Irradiation level	3000 MWD/T	—	—
Cost of fuel/ton	£18,000	£4.3.0	£12.10.0
Plutonium credit	£4.6.0 per gram of purified metal		

The value of the initial fuel was assumed not to vary throughout the reactor's life, the whole cost being included in replacement costs, so no amortisation charge was allowed for. Transport costs of nuclear fuel from the reactor for reprocessing would be higher than they were to the reactor owing to the heavily shielded containers necessary for the irradiated elements; these weighed from 30 to 50 times as much as the uranium. Even so they were still low, since a ton of uranium gave 10,000 times more heat than a ton of coal, and were almost negligible in comparison with costs of fabricating uranium elements and removal of fission products after use. Enriched fuel would cost more but would permit the use of a reactor system with lower neutron economy and higher heat output per ton of fuel and hence a lower capital cost. The high cost of a processing plant with necessary throughput of well over 1,000 tons/annum would prevent its economic use in a country without a highly developed nuclear programme, since a 300 MW reactor required only 100 tons of fuel a year for replacement.

Mr. J. C. Duckworth

Mr. J. A. Jukes

Dr. H. S. Arms

No reactor of proved reliability and capable of producing power economically in small power ranges of, say, 20 to 50 MW or 1 to 10 MW was likely to be available for at least ten years. To illustrate the possible performances of such hypothetical reactors using enriched uranium, costs per kWh were worked out for 10 MW and 20 MW nuclear power stations operated at 75 and 25 per cent load factor. This indicated 1·29d and 2·31d as possible figures for the smaller station and 0·95d and 2·05d for the larger.

Dr. H. S. Arms (English Electric, Babcock & Wilcox and Taylor Woodrow Atomic Power Co.) suggested that initial training and refresher courses in nuclear power techniques would be best obtained by the country concerned through sending selected men abroad, but research reactors (not of the type designed to produce power commercially) would also be required at home. Nine types of power reactors now being developed were described. Countries potentially wealthy enough to embark on large-scale industrialisation would wish for secure and continual supplies of nuclear fuel, which could be obtained by installing natural-uranium gas-cooled graphite-moderated reactors (which required no diffusion plant), the techniques of which were well known. Small demands for power in remote areas might be met by "packaged" reactors, such as the pressurised water or boiling water types now under development (which were described in two U.S.A. papers). Production costs of these were likely to be high but they might enable a local valuable asset to be exploited, such as a mineral deposit, where fossil fuels were unobtainable locally. High costs might not be of the first importance; in the Arctic generating costs were said to be from 17d to 26d/kWh.

In Canada, where natural uranium was plentiful, no enrichment of fuel was contemplated (Messrs. N. S. Spence and J. Convey). A 200 MW (power rating) reactor was scheduled for operation this year to provide testing facilities and also plutonium. It would use heavy water as moderator and coolant. Aluminium alloys, formerly considered corrosion resistant in water only below 150 deg C, now promised to be useful at over 250 deg C and attractive in cost for some types of reactor.

A design of an organic moderated reactor, using a liquid polyphenyl as moderator, reflector and primary heat-transfer medium, was described by Dr. C. Starr (U.S.A.), who estimated the cost per kWh for a 12·5 MW plant at 16 mils per kWh and for a 150 MW plant at 10·3 mils.

Mr. S. Okita (Japan) dealt specifically with Asia and the Far East (ECAFE), the population of which formed 50 per cent of the world total but had only 10 per cent of the world's income. His view was that, owing to the large output for which economical reactors had to be built and to the low load factors obtainable in early stages of supply systems, reliance should be placed initially on conventional power resources, especially water power, if any, in combination with irrigation schemes. Greater immediate benefits might accrue from nuclear fission through radio-isotopes in agriculture and for medical uses. Atomic energy should be left until local power systems had expanded considerably, since the capacity of any generating station connected to them should not exceed 10 per cent of the whole. Technique, fuel and capital would generally have to be imported, and too early an introduction of nuclear power might cause excessive dependence on foreign countries. Financial assistance from advanced countries would be necessary for this purpose, a substantial part of which would desirably be channelled through an international agency.

Information from Poland was that the first nuclear power station (of 200 MW) would be erected there in 1965, to be operated in conjunction with stations fired with coal and lignite.

Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

A NUMBER of tests were carried out in the course of several years to determine whether the valuable sensitivity characteristics of a.c. instruments incorporating dry rectifiers could be sufficiently stabilised to eliminate the adverse effects of ageing and temperature variations. The advent of the modern germanium and silicon types of crystal rectifiers made it interesting to compare their performance in this field with that of the older copper-oxide and selenium dry rectifiers.

The test results justify the conclusions that it is possible to improve the volt-ampere characteristics of the rectifiers considered so that they come sufficiently near to being representable by a second-order parabola instead of an exponential curve, and this simply by inserting an appropriate resistance into the circuit. The value of this resistance can be found by the method of least squares. It is equally possible to eliminate the effects of the variations of the ambient temperature by a simple compensating bridge circuit. Germanium rectifiers are for the purposes outlined superior to other dry rectifiers.—"Observations on the Use of Rectifiers in A.C. Measurements," R. Mastrantonio, *Energia Elett.*, Vol. 34, No. 3, pp. 267-276, 1957, in Italian.

Magnetising Permanent Magnets

The mass production of permanent magnets of widely differing shapes and composed of special alloys has to satisfy stringent conditions of different kinds, and the classic solenoid method of magnetising the blanks is unsuitable for a number of reasons, not least, because it is far too wasteful of time. The equipment described can be used for most of the many special shapes of magnets nowadays required and the magnetising circuit proper represents a current transformer with a single closed turn as secondary winding. The method used is to send a single pulse of magnetising energy produced by a capacitor discharge through this circuit and, by the insertion of an ignitron, to make sure that only the first positive half-wave of the oscillating discharge passes through the transformer primary.

The equipment produces a "circular" magnetic field and is therefore particularly suitable for magnetising blanks the cross-sections of which are annular or, at least, partly annular. The comprehensive mathematical analysis of the "transient phenomenon" in the circuit, i.e. its actual operating conditions, which are obviously always of transient character, is based on the assumption of a constant inductance, and followed by a full report of experimental results with oscillograms of capacitor discharges without, and with, ignitron control. The experimental equipment may also be used for the demagnetisation of magnets, in which case scroll-type paper capacitors are used instead of the electrolytic capacitors found most suitable for magnetising. The consumption of the circuit is low and it can be arranged for automatic control.—"Equipment for Magnetising Permanent Magnets," B. Fröhlich, *Elektrotech. Obzor*, Vol. 46, No. 5, pp. 221-226, 1957, in Czech.

Impulse Voltage in Transformers

It has been known since K. W. Wagner's research on the penetration of an electromagnetic wave into a coil with inter-turn capacitances (1915) that the overall phenomenon accompanying such a disturbance, at any rate in the case of a steep-fronted incident wave, is composed of two intrinsically different stages. In the initial stage the space distribution of the voltage along the winding has exponential character and is determined exclusively by the capacitive characteristics of the winding. The quasi-steady final stage is of purely inductive character, while the transition between the two takes the form of an infinite frequency spectrum of damped natural oscillations set up by the incoming wave in the individual capacitive and inductive elements. The author uses results of his previous paper on theory of an n-winding transformer to evolve a method of calculating the final potential distribution of an impulse-stressed transformer

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

on the drawing-board stage of its design, with a view to solving the problems of surge protection arising. Experimental tests yielded results in satisfactory agreement with the theory outlined.—" Method of Calculating the Quasi-Steady Space Distribution of the Impulse Voltage in Transformers with Layer Windings and Solidly Earthed Neutral," U. Rösch, *Elettrotecnica,* Vol. 44, No. 3 bis, pp. 188-194, 1957, in Italian.

Corrosion by Fuller's Earth

It was found that imported bentonite, processed in Czechoslovakia, contained sulphur which was liberated in the course of activation. This sulphur not only had strong corrosive effects on the refinery equipment, but was also bound to pass into the refined products during pulverisation. When the latter come into contact with metals, particularly copper, these will be corroded. Another undesirable effect is produced by sulphur-contaminated Fuller's earth when it is used for the treatment of insulating oils; the stability and dielectric characteristics of the latter are then severely impaired. The authors have developed a heat treatment for Fuller's earth to eliminate its original sulphur content without changing the valuable characteristics of the material.—" Fuller's Earth as Cause of Corrosion," V. Pallo, J. Prokes and V. Masek, *Elektrotech. Obzor,* Vol. 46, No. 5, pp. 245-247, 1957, in Slovakian.

Line Insulation Testing

The conditions under which volt-sec characteristics of line insulators are obtained in the laboratory are compared with those obtaining under actual atmospheric surges and the problem of standardising the conditions of surge tests carried out in h.v. laboratories is considered. One of the difficulties arising in the analysis of volt-sec characteristics and their standardisation is the distortion of the voltage-wave by the formation process of the discharge. The author's investigations on the long spark, leading to an analytical formulation of the conditions of the formation of the discharge, offer a starting point for the analysis of the causes of distortion of a standard wave in a discharge gap and render it possible to state the conditions of comparability of volt-sec characteristics obtained with different clearances in air.

This serves as a basis for the co-ordination of the insulation. To ensure correspondence between characteristics of the insulation obtained in laboratory tests and the actual service characteristics of the insulation, two conditions have to be observed, one of which cannot be fully satisfied. However, the author proved experimentally that even implementation of only the other condition renders the test results useful for the practical purpose; this is supplemented by an approximate method of estimating the error of the experimental volt-sec characteristics obtained in the usual way.—" Surge Tests on Line Insulation," I. S. Stekolnikov, *Izv. Akad. Nauk, S.S.S.R.,* No. 1, pp. 33-38, 1957, in Russian.

Testing Large Transformers

Considering the enormous accumulation of publications on all kinds of transformer testing methods devised and applied practically all over the world, it becomes ever more difficult to keep account of them and to sort them out according to their merits. For this reason a balanced summary drawn up by an expert who has made contributions of his own to the subject will always prove helpful. Also, in this field, more than in many others, economic factors loom large and it is therefore very important " not to use sledgehammers to crack walnuts," or to put it more concretely, not to erect a 2 MV surge generator where a 500 kV generator will do. On the other hand, there are many other tests beside the surge tests which, although more conventional, are more tricky in the case of large modern transformers and must be carried out as reliably (or even more so) as on smaller transformers. The author discusses and compares the practice in various European countries with U.S.A. and U.S.S.R. procedures and also considers the recommendations and regulations of the I.E.C. and various national committees.—" The Technique of Some Tests on Large Transformers," V. Hrbek, *Elektrotech. Obzor,* Vol. 46, No. 1, T1-T8, January, 1957, in Czech.

Intrinsically Safe Circuits

Results of tests on the incendivity of sparks are reported, showing that sparks produced under similar conditions have statistically distributed incendivities. It follows that very large numbers of tests are required to arrive at limiting values. There is a difference between break-sparks and make-sparks produced by short-circuiting charged capacitors. In either case the incendivity depends on contact design and a number of other factors. Of the parameters of the inflammable gas mixture, the temperature has no influence at all, pressure only a subordinate influence on the incendivity. This is not altered by variations, within certain limits, in the concentration of the components of the mixture.

In inductive circuits the incendive current depends strongly on the inductance, whereas the e.m.f. is much less important in circuits containing large inductances. A criterion of the incendivity of sparks is the energy liberated in them. The intensity of sparks in inductive circuits may, by appropriate design of the circuit, be reduced to such an extent that the sparks cannot ignite even hydrogen-air mixtures. The incendivity of capacitor-discharge sparks in methane-air mixtures is considerably lower than that of circuit-breaking sparks of the same energy content. The author states the relationship between capacitance and incendive charging potential. The investigations are important for the design of comparatively extended systems of considerable line capacitance, since the operating voltage has then to be determined in a way excluding the possibility of incendive sparking in the case of a discharge of the line capacitance on short circuit.—"Intrinsically Safe Circuits," K. Müller, *E.T.Z.(A),* Vol. 78, No. 5, pp. 177-182, 1st March, 1957, in German.

Air-Blast Circuit-Breakers

It is surprising that the cause of failures of air-blast circuit-breakers, particularly in disconnecting idling lines and transformers, by re-ignition of the arc, has not been investigated so far since it is essentially the fact that the dielectric strength of an air flow is much lower than that of still air. This, of course, does not affect in any way the fact of the excellent arc-quenching properties of an air blast, but only refers to the necessity of maintaining high dielectric strength after arc extinction.

The problem was investigated and solved by the authors who experimented with a special experimental quenching chamber in which various electrode forms were tested and also with a commercial U.S.S.R. air-blast breaker. Conditions can be substantially improved by the use of the most appropriate form of contact (electrode) as well as by reducing the sections of the openings of the hollow contacts and working with a single cross blast.—" The Dielectric Strength of the Air in an Air-Blast Circuit-Breaker," N. Z. Aronzon, V. N. Borisov, *Izv. Akad. Nauk, S.S.S.R., Otdel. tekh. Nauk,* No. 1, pp. 149-152, 1957, in Russian.

New Books

Atomkraft. By Dr. Engr. Friedrich Münzinger. Pp. 224; figs. Springer-Verlag, Reichpietschufer 20, Berlin W.35. Price, DM 29.40.

This is the second edition of a work on atomic energy first published in 1955. It has been revised and enlarged to take the most recent developments into account including those of the Geneva Atomic Congress 1955 and the 1956 World Power Conference in Vienna and is intended to provide practical engineers and power industrialists with an introduction to the construction of atomic power plant and its related problems. Only reactors for the industrial production of power and heat in stationary installations are dealt with. Reactors for marine, vehicle or aircraft propulsion are not described and those for laboratory purposes are only introduced to the extent necessary for the author's treatment of the subject which aims at conciseness and avoiding non-essential scientific issues so that the present position of knowledge within the scope of the work is presented in a way which is easily understandable. With nuclear engineering in its comparative infancy, there is a continual flow of new information and allowance must be made for any modifications which would have been made had the relative information been known in time.

The arrangement is in three main divisions:

(a) Theoretical part: covering the principles of nuclear physics; the cooling of reactors; constructional materials and fuel.

(b) Technical part: dealing with the construction of reactors, including descriptions and critical comparisons of various systems; thermal machinery for reactors, and the construction of atomic power plant.

(c) Economic aspects: this section discusses the competitive features of atomic power plants, giving comparative data and the factors to be borne in mind when making a long-view assessment of the future of industrially applied atomic energy as applicable to the German Federal Republic. The views expressed by the author in this section are based on data and experience from other countries.

Ample use is made of tables and diagrams for providing information in a readily acceptable and comparative form, whilst indexes by subject and author afford a means of quick reference.—L.M.B.

The Art and Science of Protective Relaying. By C. Russell Mason. Pp. 410; figs. John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 96s.

This is a comprehensive and highly competent work which adequately covers the principles and practice of protection. It is essentially practical, mathematics being used mainly to express torque relationships and operating principles of relays and to calculate the relay operating currents and voltages under system fault conditions. The last-mentioned is not essential to an understanding of the principles of protection, but the sections on relay operating principles and on the use of the R-X diagram are pertinent and valuable.

The subject matter falls into four main sections—the general " philosophy " of protection, the principles underlying the relays used, the application of the relays to schemes of protection for the various elements of a power system, and a section on the characteristics and connections of current and voltage transformers which serves essentially to bridge the second and fourth main sections of the book.

In the light of the statement (p. 10) that " Unless a person is thoroughly acquainted with relay testing and maintenance, he can do more harm than good, and he might better leave the equipment alone," the absence of any guidance on this aspect seems rather odd.

The author, who owes allegiance to a particular firm manufacturing protective equipment in the United States, believes, with justice, that he has avoided " any taint of commercialism." That the book is " timeless " may be more open to question, but there is little doubt that the great bulk of the subject matter applies generally to both North American and British relaying practice, and will continue so to do until new techniques, governed by different principles, supersede it.

There are differences of practice and of nomenclature, as between this country and the United States, but they are fewer than might be expected. An example of the former is the use of combined phase and direction-comparison schemes on lines with mutual inductance (incidentally, the final syllable of the first word in " directional-comparison " seems unnecessary, since it is " direction " that is compared). A more pertinent example of nomenclature difference, however, is " wire-pilot relaying," which is used to distinguish between " current-differential " schemes, as applied to transformers, generators, and busbars, and " circulating-current " or " opposed-voltage " schemes as applied to lines. All are inherently " current-differential " schemes; but the distinction is useful and apt, since the word " pilot " really has significance only when the ends being compared are widely separated, as in line protection.

A bibliography, designed to direct readers to source material and proofs in support of the text, accompanies each chapter. Also, which is unusual in a book on protection, one or more problems are given at the end of each chapter. This justifies the author's belief that the book will be of assistance in teaching the subject although answers to the problems are not given.—M.K.

BOOKS RECEIVED

Introductory Electrical Engineering. By G. F. Corcoran, M.S., and H. R. Reed, Ph.D. Pp. 527; figs. John Wiley & Sons Inc., New York. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 64s.

Applied Electrical Measurements. By I. F. Kinnard. Pp. 600; figs. John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd. Price 120s.

Vacuum-Tube Circuits and Transistors. By L. B. Arguimbau. Pp. 646; figs. John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd. Price 82s.

Records and Research in Engineering and Industrial Science. 3rd Edition. By J. E. Holmsbrom, Ph.D., A.M.I.C.E. Pp. 490; figs. Chapman & Hall, Ltd. Price 60s.

Amplifiers: Design and Construction. Edited by F. J. Camm. Pp. 280; figs. George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Price 17s 6d.

Les Semiconducteurs Diodes, Transistors et Autres Applications. By G. Goudet and C. Meuleau. Pp. 439; figs. Editions Eyrolles, 61, Boulevard Saint-Germain, Paris, Ve, France. Price 5,720 francs.

GENERATION AND DEVELOPMENT

Shrewsbury Reinforcement

To help to meet the rising demand for electricity in the Shrewsbury district, the Midlands Electricity Board is reinforcing its major distribution substation at Comet Bridge, adjoining the Sub-Area headquarters at Spring Gardens, by installing two English Electric 20 MVA transformers to supplement the two existing 7·5 MVA units installed in 1951. The new plant will convert incoming 33 kV supplies for distribution at 11 kV to a wide area covering the centre and northern parts of the town and reaching as far as Alberbury to the west, Preston Gubbals to the north, Uffington to the east and Westbury to the west.

Explaining the need for the Comet Bridge reinforcement scheme, which is expected to cost upwards of £80,000, the manager of the Board's Shropshire and Herefordshire Sub-Area, Mr. W. Winwood, said that the load on the distribution system in the Shrewsbury District now had more than 23,000 consumers compared with 17,000 in 1951, and annual sales had increased from 31 million to over 73 million kWh in the same period. One reason for the increased demand might be that, following the completion of the change-over from d.c. to a.c. last year some commercial consumers were now getting more modern equipment. In addition considerable industrial development was taking place on the northern side of the town.

Rural Electrification in the North-East

A report on the progress of the North Eastern Electricity Board's rural electrification scheme was submitted at a recent meeting of the North Eastern Area Consultative Council. During the year ended 31st March last, 1,384 farms were connected compared with 1,273 the previous year. There were 18,838 farms in the Board's area and of these, 12,106 (representing 64 per cent of the total) had been connected, leaving 6,732 to be dealt with. All villages and hamlets in the Board's original five stage plan are now on supply with the exception of two. After outlining the number of villages, hamlets and small communities where negotiations for electricity supplies were proceeding, the Board dealt with areas where supply schemes had been deferred because prospective consumers would not agree to terms. Since vesting day the Electricity Board had spent £4,300,912 on rural electrification, and during the current year it was proposed to spend another £826,000. This would cover supplies to 1,300 farms.

Another report submitted to the Consultative Council stated that during March, April and May, h.v. supplies were afforded to twenty-six industrial and commercial consumers, and 205 miles of cable and mains were laid. The Board has approved estimates amounting to £1,074,907, including seventy-seven housing supply schemes and 133 rural supplies.

Some 50 Mazda "Sapphire" lanterns, housing 400 W mercury lamps, are used for the lighting of the new Merdeka Bridge, Singapore. They are mounted on 25ft steel columns spaced at intervals of 80ft on both sides of the road. The bridge is 2,000ft long

Increased Charges in North-East

Mr. T. M. Ayres, chairman of the North Eastern Electricity Board, announced on Monday that the Board had been forced to review its tariffs because of increasing costs. He said that the latest increase in coal prices would cost the Board about £325,000 in a full year. This year the extra costs facing the Board were £1,329,000 and next year these would rise to £2,757,000. He estimated that the increased charges would bring in about £1,320,000.

Fall in Output in June

Last month 6,051 million kWh was generated by the Central Electricity Authority, the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board, a reduction of 1·5 per cent compared with June, 1956. In the first six months of the year 45,124 million kWh was generated, an increase of 1 per cent.

OVERSEAS

Water Power Still Basis of Sweden's Power Expansion

Fifteen new water power stations with a total output of 9,595 million kWh per annum are planned by the Swedish State Power Board for completion by 1963. The plans for the five-year period 1964-68 envisage the building of a further eleven stations with a total capacity of 6,030 million kWh a year. This would leave some 50 plants with an aggregate output of 13,000 million kWh and each with a capacity exceeding 100 million kWh per annum to be built until Sweden's harnessable water power resources are more or less fully exploited by 1985, the State Power Board announces in a survey.

While atomic power is likely to become of increasing importance, the State Power Board says that considering the development work required it seems probable that water power, supplemented with conventional thermal power in dry years, will form the basis of the country's power output up to the end of the 1960s.

Among Sweden's numerous rivers, the Lule River in Lapland, with a potential of over 14,000 million kWh per annum, is by far the most important for harnessing. So far about 3,600 million kWh is being produced annually by three plants at Porjus, Harspranget and Ligga, while 1,000 million kWh will come from new developments. Plants to be completed on the Lule River by 1963 include Porsi (960 million kWh per annum), Messaure (1,800 million kWh) and Edeforsen (750 million kWh).

New Zealand Power Plan

The New Zealand Government has announced a plan to spend £235 million on power development over the next thirteen years. A report released by the Minister of Works, Mr. S. Goosman, says the plan provides for geothermal, gas turbine and hydro-electric power stations. It recommends approval in principle of linking the North and South Island power systems by submarine cable across Cook Strait at a cost of about £16 million. The estimated cost of the Benmore hydro-electric power station, to be built on the Waitaki River, in the South Island, is £36 million. The station, which will produce 480,000 kW, will be the largest in the southern hemisphere, the report says. Preliminary work on the site has started and the station should be finished early in 1966.

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets have been conditioned mainly, of late, by evidence of the Government's intensified concern over the pressure of inflation. At one time industrial ordinary shares retreated fairly sharply under the impression that the Chancellor might decide to take immediate measures of a drastically restrictive character. When his latest speeches did not seem to confirm this as an early prospect, prices resumed a steadier appearance, helped by the signs of rising industrial production and by the improvement in the overseas trade returns. As a result, price movements have been irregular, with no very substantial changes either way. Gilt-edged stocks could draw little comfort from the week's Government pronouncements. Quotations of some issues fell to the lowest points in their history when it became apparent that no official action is intended to interfere with the natural course of the market.

Richardsons, Westgarth Capital

In his statement circulated to shareholders of Richardsons, Westgarth & Company in advance of the annual meeting held to-day (Friday), the chairman discloses the intention to make in due course a scrip distribution through a capitalisation of part of the reserves invested in the business, and also to raise new permanent finance in a form to be decided later. While the former issue will have the effect of making the balance sheet a better reflection of the group's position, the new money will be required as a contribution to the cost of a capital expenditure programme shortly to be raised to some £6 million, spaced over the next four years, much of which will be provided from internal resources and retained profits. Referring to prospects, Mr. O. J. Philipson says that with orders on hand to a value of more than £40 million (excluding the recently acquired Humber and Parsons Marine companies) the future can be regarded with some confidence. At 18s 9d, the 5s ordinary shares show, on the basis of the 16⅔ per cent dividend, a yield of just on 4½ per cent. This would very likely be improved if the new cash issue were to take the shape of a " rights " offer of shares.

Price Changes

Ever Ready 5s shares, at 19s 3d, and Allen West 5s shares, at 12s 3d, are now quoted ex-capitalisation issues of 100 per cent in the first case and 30 per cent in the second. If present dividend rates are scaled down in proportion to the increases in capital, the prospective yield on both shares is in the neighbourhood of 4¾ per cent. English Electric rose strongly at one time to 64s 3d, the best price of the year, before a partial reaction to 63s 9d. Crompton Parkinson, Simon-Carves, John Thompson and Reyrolle also gained ground on balance. The rise in Morphy-Richards was continued up to 19s and Decca " A " improved, but Hoover came back to 41s 3d and lower prices were marked also for E.M.I., Plessey, De La Rue and Pye. In the

Price Changes in

Company or Board	Nom. Value	Middle price 15th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	71½	−1	3	3	4 4 0	80	71½
Brit. Elec. 1974/77	100	69½	−1	3	3	4 6 3	78½	69½
Brit. Elec. 1976/79	100	73½		3½	3½	4 15 3	81½	73½
Brit. Elec. 1974/79	100	83½	−1	4½	4½	5 1 9	92½	83½
Overseas Electric Supply								
Calcutta Elec.	£1	15/-	−1/-	6†	6†	8 0 0†	19/-	15/-
East African Power	£1	19/-		7	7	7 7 3	21/-	19/-
Nigerian Elec.	£1	17/6		10	10*	11 8 6	18/6	17/3
Perak Hydro-Elec.	£1	17/6		10	10*	11 8 6	18/-	13/3
Electrical Shares								
Aberdare Cables	5/-	12/6		17½	17½	7 0 0	12/6	9/9
Aerialite	1/-	5/9		45	48	8 6 9	6/-	4/9
Allen, W. H.	£1	46/10½		10	10	4 5 6	47/3	33/6
Anglo-Portuguese Tel.	£1	24/9	+6d	8	8	6 9 3	27/6	20/6
Aron Elec. Ord.	£1	58/9		15	15	5 2 3	60/-	53/6
Assd. Automation	10/-	23/9	−6d	5	7½	3 3 3	24/9	17/9
Assoc. Elec. Ord.	£1	62/6		15	15	4 16 0	73/-	62/6
Automatic Tel. & El.	£1	75/-		15	17	4 10 9	75/-	54/6
Babcock & Wilcox	£1	70/-		15	15	4 5 9	82/6	70/-
Bakelite	10/-	23/9	−6d	16	15	6 6 3	24/6	20/9
Baldwin, H. J.	2/-	3/10½		20	20	10 6 0	5/-	3/10½
Berry's Electric	5/-	6/-	−2/6	—	10	8 6 9	6/3	5/6
British Aluminium	£1	65/-	−2/6	12	12	3 13 9	71/3	63/9
Brit. Elec. Traction: Def. Ord. " A "	5/-	24/-x.d.	+6d	22½	25	5 4 3	24/6	17/-
B.I. Callender's	£1	50/-	−1/-	12½	12½	5 0 0	55/-	48/3
B.I. Callender's 6% Pref. ...	£1	19/6		6	6	6 3 0	21/9	19/6
British Tabulating	£1	55/-		9	9	3 5 6	56/3	42/-
British Thermostat	5/-	25/-		25	25	5 0 0	27/6	25/-
British Vac. Cleaner	5/-	6/-	−6d	15	10	8 6 9	8/-	6/-
Brook Motors	10/-	37/6		25	15	4 0 0	37/6	30/-
Brush Group	5/-	7/9		10	Nil	—	8/-	4/6
Bulgin, A. F.	1/-	4/9		50	40*	8 8 6	5/6	4/6
Burco Dean	5/-	14/-	+6d	22½	20	7 2 9	14/-	8/9
Cable & Wireless: Ord.	5/-	12/6	+6d	10	10	4 0 0	12/6	9/6
4% Loan	100	90½		4	4	4 8 6	92½	89
Chloride El. Storage " A " ...	£1	66/10½		17½	17½	5 4 9	68/9	58/-
Clarke Chapman	£1	175/-	−5/-	22½	27½	3 2 9	9	6½
Cole, E. K....	5/-	21/-		17½	17½	4 3 3	23/6	16/6
Cossor, A. C.	5/-	5/9		15	Nil	Nil	7/3	5/9
Crabtree	10/-	25/6		20	20	7 17 0	26/-	23/3
Crompton Parkinson Ord. ...	5/-	17/6	+9d	16	16	4 11 3	17/9	14/6
De La Rue	5/-	22/3	−2/3	30	35	7 17 3	24/6	16/3
Decca " A "	4/-	28/3	+3d	43¾	43¾	6 4 0	32/3	26/10½
Desoutter	5/-	35/6	+1/9	30	32½	4 11 6	35/6	27/6
Dewhurst	2/-	7/6		30	16½*	4 6 9	7/6	5/9
Dictograph Tel.	2/-	5/9		20	20	—	6/3	5/9
Dubilier Condenser	1/-	7/6	+3d	25	30	4 0 0	7/6	5/6
Duport	5/-	19/-		23	25	6 11 6	19/6	17/6
E.M.I.	10/-	32/9	−2/-	15	15	4 11 6	34/9	23/9
Electrical Components	5/-	7/6		25	25	8 6 9*	7/6	6/6
Elec. Construction	£1	26/3		8½	8½	6 9 6	27/6	21/9
Elliott Bros.	5/-	31/6	−9d	17½	20	3 3 6	33/6	26/3
Enfield Cable Ord.	£1	14/-	−6d	Nil	Nil	Nil	21/6	13/-
English Electric	£1	63/9	+2/6	12½	14	4 7 9	63/9	47/6
English Electric 3¾% Pref. ...	£1	12/-		3¾	3¾	6 5 0	14/3	13/-
Ericsson Tel.	5/-	49/6	+6d	20†	22†	2 4 6	49/6	33/3
Ever Ready	5/-	19/3x.c.	−3d	35	37½	4 17 6*	20/-	15/-
Falk Stadelmann	£1	39/8½		17½	17½	8 16 6	40/6	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

gilt-edged market, British Electricity stocks showed further losses of up to a point.

Hackbridge & Hewittic

In the full annual report now published by Hackbridge & Hewittic, the intake of orders received during the year to last March is described as a record, and orders now in hand as being some 30 per cent greater than they were twelve months ago. During the last period, output was maintained but the contraction of profit margins reduced the group trading profit from about £534,000 to £440,000, as a result of which the ordinary dividend was lowered from 23 to 20 per cent. The directors feel now that the group has both the work on hand and the facilities in the factory to produce successful results in the current year, given reasonably stable working conditions. The 4s shares are quoted at 15s to yield approximately 6¾ per cent.

Electrical Investments

Company or Board	Nom. Value	Middle price 15th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1957 Highest	1957 Lowest
Electrical Shares—continued								
G.E.C. Ord.	£1	55/-		12½	14	5 1 9	58/9	48/9
G.E.C. 6½ Pref.	£1	20/6		6½	6½	6 6 9	23/6	20/6
General Cables	5/-	14/3	+6d	30	30	10 10 6	14/3	11/6
Greenwood & Batley	£1	47/6		17½	17½	7 7 3	47/6	45/3
Hackbridge Holdings	5/-	19/3	+6d	25	30	7 15 9	21/9	18/9
Hackbridge & Hewittic	5/-	15/-		23	20	6 13 6	16/-	13/6
Head Wrightson	£1	143/9		20	22½	3 2 6	146/3	112/6
Heatrae	2/-	4/9	+3d	15	15	6 6 6	4/9	4/-
Henley's	10/-	15/-		11½	11½	7 13 3	17/-	15/-
Holophane	5/-	25/-		30	30	6 0 0	26/3	17/-
Hoover	5/-	40/-	−2/6	50	50	6 5 0	44/-	24/9
I.C.I.	£1	45/-	−3d	10	10	4 9 0	46/6	37/9
Intl. Combustion	5/-	27/3	+9d	20	22½	4 2 6	30/-	20/-
Johnson & Phillips	£1	28/1½		15	10	7 2 3	34/6	28/-
Lancashire Dynamo	£1	42/6	−1/3	11	11	5 3 6	45/-	36/9
Laurence, Scott	5/-	17/9		15	15	4 4 6	19/9	13/9
Lister, R. A.	£1	32/3	−3d	10	10	6 4 0	33/9	26/9
London Elec. Wire	£1	47/6	+6d	12½	12½	5 5 3	53/9	43/-
Lucas, J.	£1	35/-	−6d	7½	7½	4 5 9	36/6	30/6
Marconi Marine	£1	35/-		10	10	5 14 3	35/-	31/-
Marryat & Scott	2/-	13/-		30	35	5 7 9	13/-	8/-
Mather & Platt	£1	61/3		15	15	4 18 0	63/9	51/3
Metal Industries	£1	29/3	−9d	Nil	9	6 3 0	30/-	20/3
Midland Elec. Mfg.	£1	48/9		12½	12½	5 2 6	48/9	45/-
Morphy-Richards	4/-	19/-	+3d	50	50	4 4 3*	19/-	11/9
Murex	£1	78/3	−1/-	20	20	5 2 3	79/6	65/-
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/1
Oldham & Son	1/-	2/6	+1½d	17½	17½	7 0 0	2/6	2/3
Parnall (Yate)	5/-	7/3		12	12	8 5 6	8/9	5/9
Parsons, C. A.	£1	66/3	−1/3	10	8½*	—	71/3	50/6
Plessey	10/-	84/6	−1/3	27½	30	3 11 0	86/3	61/-
Pye "A" Deferred	5/-	18/9	−1/3	12½	12½	3 6 6	20/-	15/9
Reyrolle	£1	101/3	+1/3	16½	17½	3 9 3	110/-	90/-
Rheostatic	4/-	9/-		18½	12½*	5 11 0	10/-	8/9
Richardsons Westgarth	5/-	18/6	−3d	16¾	16¾	4 10 0	20/-	17/-
Scottish Cables	4/-	17/9	+6d	27½	27½	6 4 0	19/3	15/-
Simon-Carves	5/-	36/3	+1/3	28¾	20*	2 15 3	36/3	26/-
Smith (England), S.	4/-	15/-		17½	17½	4 13 3	15/9	13/-
Southern Areas	£1	15/-		7½	7½	10 0 0	20/-	13/9
Strand Elec.	5/-	7/3		15	15	10 6 9	8/-	7/3
Sturtevant	5/-	23/6	+9d	15†	15†	3 3 9	27/-	22/9
Sun Elec.	£1	43/9		20	25	11 8 6	43/9	43/9
Switchgear & Cowans	5/-	13/9		25	25	9 1 9	15/6	13/6
Taylor Tunnicliff	5/-	12/9		15	15	5 17 9	13/9	11/9
T.C.C.	10/-	40/-		25	25	6 5 0	40/-	35/-
T.C. & M.	£1	25/-		8½	8½	6 16 0	31/-	24/6
Telephone Mfg.	5/-	6/-		10	10	8 6 9	8/-	5/9
Telephone Rentals	5/-	12/-	+3d	12½	12½	5 4 3	12/6	10/3
Thompson (John)	5/-	33/9	+1/6	25	25	3 14 0	37/-	29/3
Thorn Elec.	5/-	25/7½		15	15	2 18 6	26/3	16/3
Thornycroft	£1	28/9		15	12½	8 14 0	37/6	28/9
Tube Investments	£1	67/6	+1/3	22½	15*‡	4 9 0	68/9	58/3
Vactric	5/-	18/9x.d.		17½	25	6 13 4	23/9	12/9
Veritys	5/-	8/6	−6d	12½	12½	7 7 0	9/3	8/3
Walsall Conduits	4/-	14/4½		20	20	5 11 3	15/-	11/-
Ward & Goldstone	5/-	56/3	+2/6	30	35	3 2 3	56/3	36/9
Watford	2/-	6/6		25	25	7 13 9	6/9	6/3
Westinghouse	£1	38/9		18	9‡	4 13 0	41/3	36/-
West, Allen	5/-	12/3x.c.		15	15	—	13/6	9/6
Wolf Electric	5/-	11/6		20	20	4 7 0*	13/6	8/9

Conservative Dividends

In repeating the previous year's dividend rate of 17½ per cent, Oldham & Son are dealing conservatively with the profits of the year ended last March, for the group surplus of £266,000 after tax is about one-third higher than before and appears, from the preliminary statement, to be more than four times the amount of the distribution. The 1s shares hardened to 2s 6d after the announcement and offer a yield of 7 per cent. Marryat & Scott 2s shares, which have risen steadily from 8s 9d since the beginning of this year, have improved further to 13s since the announcement of the increase in 1956–57 earnings and in the dividend, from 30 to 35 per cent. The new rate absorbs less than a third of the surplus available for distribution and reserves. Profits of Berry's Electric Magicoal give practically five-fold cover for the 10 per cent dividend to be paid for the twelve months ended in March.

Avo Dealings

Following the granting of an official Stock Exchange quotation, dealings have been taking place in Avo, Ltd., 2s ordinary shares at prices around 7s. The directors envisage a dividend for the current year of not less than 20 per cent. This rate would be covered about 2½ times over on the basis of the last profits, and would produce a yield approaching 6 per cent on the shares at their present price. Issued capital is £250,000, all in ordinary shares.

Metal Industries Recovery

While a preliminary statement of the Metal Industries results for 1956–57 had reported a conversion of the previous year's trading loss of half a million into a profit of over £1½ million, the chairman in his review accompanying the full report is nevertheless not convinced that the subsidiaries' profits are the best that could be achieved. The price of the company's £1 shares (which were as low as 16s 3d at times last year) has risen from 27s to 29s 3d since the final dividend declaration at the beginning of this month. This made a total for the year of 9 per cent (the rate paid for 1954-55) and was accompanied by a special bonus of 5 per cent. The latter has reference to the fact that no distribution was made last year, and shareholders are advised not to base their future dividend expectations upon it. On the dividend alone, the yield on the shares works out at a fraction over 6 per cent.

REPORTS and DIVIDENDS

Richardsons, Westgarth & Co., Ltd.—In his annual review covering the year ended 31st March last, Mr. O. J. Philipson (chairman) says that the allocation of £250,000 to reserve for atomic and other developments is considered prudent, especially in the light of the heavy initial costs that must be met in order to participate in the rapidly widening field of nuclear energy. Capital expenditure commitments at 31st March amounted to approximately £3 million. The complete schemes of extension and modernisation, as now planned, will shortly raise their programme to some £6 million. This expenditure will extend over the next four years. A large part will be provided from the group's general resources, but these will have to be supplemented by the raising of additional capital. They propose to apply to the Capital Issues Committee for permission to capitalise part of the reserves, and they are investigating the most suitable form for raising additional permanent finance.

Technical progress proceeds unabated and the call for higher powered machinery for ships and power stations has continued. These demands are being met by the group in the forms of supercharged diesel engines and larger-sized steam turbines. Mr. Philipson refers briefly to the progress of the various companies in the group and says that with orders on hand of a value exceeding £40 million, exclusive of the recently acquired Humber and Parsons Marine Companies, over one-third more than at the same time last year, the future can be looked to with some confidence.

John Thompson, Ltd.—In his review of 1956, which has been circulated with the report and accounts, Mr. E. W. Thompson (chairman and joint managing director)—who received a knighthood in the Birthday Honours—says that the company's output for the year was the record figure of £26·5 million, an increase of 14 per cent over the previous year. In spite of the increased turnover the orders on hand not invoiced at the end of the year at nearly £38 million show an increase of £4 million over the previous year, and at the end of March this year showed a further increase of £500,000. To finance these additional orders, and especially the additional capital equipment, the board recommended an increase of £750,000 in the authorised capital of the company and an issue of 1,048,227 ordinary shares of 5s each, subsequently converted into stock. At an extraordinary meeting after the annual meeting, members of the company will be asked to approve an amendment to the Articles of Association to the effect that the directors' borrowing powers shall be increased to £5 million.

The year 1956 has been a year of achievement, and they are beginning to see the results of earlier expenditure and effort. Last year he warned shareholders that nuclear power developments would probably involve them in additional expenditure. This covers various items essential for the development of their manufacturing plans for atomic power. They have built at Ettingshall a new works for the Ordnance Company, which, in addition to its work for the Admiralty, is manufacturing the charge and discharge gear for their first nuclear power station at Berkeley. Other capital plans already nearing completion include an extension to the pipe works, again directly concerned with heat exchanger parts for nuclear power. They have also to take their share of the capital expenditure on research laboratories, extra drawing offices, etc., at Radbroke, near Knutsford, the main headquarters of the A.E.I. - John Thompson Nuclear Energy Co., of which they are one-third shareholders.

After referring to the progress of the group of companies at home and overseas, Mr. Thompson says that the progress of their work for the Atomic Energy Authority's fast reactor at Dounreay is satisfactory and the bulk of the work should be finished by the end of August this year. Their new research building came into use during 1956. With regard to the future, the output of the home companies shows a moderate increase, and orders on hand are better than at this time last year. At the present time orders on hand for home and overseas companies combined are over £38 million.

Berry's Electric Magicoal, Ltd.—The main figures in the accounts for the year to 31st March last were given in our last issue. In his circulated statement, Mr. R. Berry (chairman and managing director) says that sales for the year attained a record level, but there was a reduction in profit percentage owing to higher production and operating costs. Whilst the demand for their products has been satisfactorily maintained, sales of Magicoal fires and electric water heaters continue to be restricted by purchase tax. Export sales have been as satisfactory as possible, having regard to the instability of the home market and international difficulties during the year. Lately there has been a marked increase in sales of Magicoal fires to the United States.

Metal Industries, Ltd. — The accounts for the year ended 31st March last were reviewed in our last issue. In his circulated statement, Sir Charles Westlake (chairman) says that they have done far more than merely recover from the disastrous results of the previous year; the trading profit for the year under review is almost equal to the highest profit ever made in the history of the company. Reviewing the activities of the subsidiary companies, Sir Charles says that the record of the Igranic Electric Co., Ltd., has been one of solid, steady achievement. Production increased by some 17½ per cent over the previous year and the small loss during that year was turned to a satisfactory profit. Equipment supplied included the control gear for one of the largest automation plants in the country, and the successful launching of a new type of electro-mechanical brake which is particularly suitable for steel mills and crane control.

Brookhirst Switchgear, Ltd., earned a small profit on the year's trading, as against a loss in the previous year, and output was at a higher level. To correct the serious weaknesses in general administration reported last year, there has been extensive managerial reorganisation. Overdue orders have been virtually cleared and deliveries now quoted are much more in line with market requirements than they were a few months ago. Although the order book remains at a high level, a substantial proportion of it, particularly for equipment required in the nuclear energy and shipbuilding fields, comprises long-dated contracts. This has resulted in productive capacity being in excess of the demand upon it for the remainder of the current financial year. Steps are being taken to meet the problems arising from this situation.

Vactric, Ltd.—In his review of the past year, Mr. W. C. Pegley (chairman and managing director) says that it proved particularly difficult for the domestic electrical appliance trade, but although the turnover on the home market suffered a small decline, the resulting loss of profit was more than made good by substantial improvements in the results of the group's other activities—the manufacture of precision tools and control equipment, and the financing of hire purchase—and by the earnings of the new trading subsidiaries. Export trade has been disappointing and in Canada a trading loss resulted and considerable development expenditure had to be met. Vactric (Precision Tools), Ltd., has continued to progress and again registered an output and net profit in excess of its previous year's record. The directors are attaching much importance to the Vactric washing machine introduced in May this year.

Ruston & Hornsby, Ltd.—Output of the company during the year ended 31st March last showed some increase over the previous year, states Mr. W. J. Ruston (chairman) in his annual review, but the increase was not spread evenly over all their products. In the case of smaller sizes of oil engines, an acute shortage of work has involved a measure of short time working in some sections of the factories. The hiatus created by the

changeover of designs has been prolonged by the effect of the credit squeeze on their customers and the situation has been aggravated by the Suez crisis.

Mr. Ruston briefly refers to the activities of the subsidiaries and associates and to the centenary of the company. Dealing with exports, he says that in spite of the cessation of practically all business to most of the countries in the Middle East, their direct and indirect exports continue to represent about 70 per cent of the turnover. The Argentine market has shown definite signs of improvement, and exports to Indo-China, Persia and Malaya, and South Africa show welcome increases. Mr. Ruston concludes by referring to the progress made by the various sections of the business.

George Cohen 600 Group, Ltd., reports combined profits for the year to 31st March last of £2,336,628, as compared with £1,856,808 for the preceding year, and after meeting all charges, including £1,238,942 for taxation, the net balance is £1,097,686 (against £889,991), of which £1,092,462 is attributable to the parent company; to this is added £175,198, provisions no longer required. The amount transferred to the general reserves of the parent company and of the subsidiary companies is £420,660, and it is proposed to pay a final dividend of 8½ per cent on capital increased by a one-for-four rights issue, making with the interim dividend of 3½ per cent on the smaller capital, 12 per cent for the year (against 11 per cent). The balance added to the carry-forward in the accounts of the parent and subsidiary companies is £524,374.

Associated British Engineering, Ltd., reports a group trading surplus for the year to 31st March last of £594,990, as compared with £648,101 for 1955-56, and after meeting all charges, including £201,375 for taxation, the net profit is £182,663 (against £304,856). General reserve receives £100,000 and the dividend for the year is maintained at 10 per cent by a final payment of 6 per cent. The balance carried forward is £83,810 (against £77,501 brought in).

The Pulsometer Engineering Co., Ltd., has acquired the whole of the issued share capital of the Self-Priming Pump & Engineering Co., Ltd., Slough, manufacturers of aircraft fuel pumps and hydraulic equipment. Mr. F. B. Duncan, chairman, and Mr. J. S. Woodrow, managing director of Pulsometer, have joined the board of the Self-Priming Pump & Engineering Co.

Aiton & Co., Ltd., propose to make a scrip issue of two 10s ordinary shares for every one held. This will capitalise £500,000 of reserves.

Allen West & Co., Ltd.—At an extraordinary meeting held on 9th July resolutions were passed increasing the capital to £2,500,000 and authorising the issue of three fully paid ordinary shares of 5s each for every ten shares held.

New Companies

Inductosyn, Ltd.—Registered 17th June. Capital £100. To promote and develop the manufacture, sales and export of electronic and electro-mechanical position finding and position control devices, etc. Regd. office: 56, Vicarage Lane, Ilford, Essex.

Lighting Maintenance Co., Ltd.—Registered 17th June. Capital £100. Directors: L. R. Courtney and C. R. Lyon (directors of Courtney Pope, Ltd., etc.), and A. H. Olson (director of Courtney Pope (Electrical), Ltd., etc.). Regd. office: Amhurst Park Works, Seven Sisters Road, Tottenham, N.15.

Penmar & Co., Ltd.—Registered 17th June. Capital £100. Electrical engineers and contractors, etc. Directors: G. A. Davenport and F. Gyford (directors of G. A. Davenport, Ltd., etc.), and H. S. T. Penning and A. J. Marden. Regd. office: 97, Ashmore Road, W.9.

Thermalay, Ltd.—Registered 17th June. Capital £100. Manufacturers of and dealers in electrically heated felts, carpets and other floor coverings and underlays, blankets, pads, etc. Directors: A. R. Illingworth, C. F. Lane, C. P. Crossley and Cyril R. I. Lane. Regd. office: Shelf Mills, Shelf, near Halifax.

Butterworth Bros. (Electrical), Ltd.—Registered 17th June. Capital £5,000. To acquire the business of electrical contractors and engineers carried on by G. and P. Butterworth at 59, Savery Street, Hull, as "Butterworth Bros.", etc. Directors: G. Butterworth and P. Butterworth. Regd. office: 101, Park Grove, Hull.

Framlingham Engineering Co., Ltd.—Registered 18th June. Capital £1,000. Electricians, electrical and mechanical engineers, etc. Solicitors: C. G. Metson & Co., 58, Mark Lane, E.C.3.

S. V. Corry & W. J. Garner, Ltd.—Registered 18th June. Capital £100. Electrical engineers, general electrical installation contractors, etc. Directors: S. V. Corry and W. J. Garner. Regd. office: 2, Albany Road, Liverpool, 7.

Automatic Electrical Control Co., Ltd.—Registered 18th June. Capital £100. Manufacturing electrical engineers, electrical contractors, radio and television engineers, etc. Regd. office: Cornwall Buildings, 45, Newhall Street, Birmingham, 3.

Southport Armature Winding Co., Ltd.—Registered 14th June. Capital £1,000. Electrical engineers, armature winders, etc. Directors: N. S. Shaw and Mrs. Dorothy Shaw. Regd. office: 14a, Bridge Street, Southport.

Cheltfye, Ltd.—Registered 31st May. Capital £100. Electrical engineers and contractors, etc. Reg. office: 156, Strand, W.C.2.

Hafnite, Ltd.—Registered 31st May. Capital £100. Particulars similar to Cheltfye, Ltd.

Modern Electric Co. (Rushden), Ltd.—Registered 30th May. Capital £3,000. Directors: B. J. Davies, Mrs. Winifred C. Davies, H. J. Yates and Mrs. Emily Yates. Reg. office: 52, Grove Road, Rushden.

Holdroman Engineering Co., Ltd.—Registered 3rd June. Capital £100. Electricians, electrical engineers, etc. Reg. office: Chancery House, Chancery Lane, W.C.2.

Raymond Woodhead, Ltd. — Registered 3rd June. Capital £2,500. Electrical engineers, and contractors, manufacturers of radio apparatus, etc. Directors: R. Woodhead, Mrs. Mary E. Woodhead and B. Haley. Reg. office: 783, Manchester Road, Bradford.

Geni-Rotaflex (Design & Development), Ltd.—Registered 30th May. Capital £100. Designers, manufacturers and development engineers of electrical lighting equipment, etc. Directors: B. Stern and J. D. Vanstone. Reg. office: 4/10, Nile Street, N.1.

Wesmid Electrical (Wholesale), Ltd.—Registered 12th June. Capital £100. Manufacturers and distributors of, agents for and wholesale and retail dealers in electrical goods of all kinds, radio and television receivers, etc. Directors: M. Brown and Marguerite J. Marsh. Regd. office: "Trelissick," Newlands Green, Malvern, Worcs.

Endura Lamps, Ltd.—Registered 12th June. Capital £10,000. Manufacturers of and dealers in electric lamps and bulbs, etc. Solicitors: Howard Kennedy & Co., 19, Cavendish Square, W.1.

Cowley & Wilson (Electrical), Ltd.—Registered 13th June. Capital £2,000. To acquire the electrical contracting business now carried on by Cowley & Wilson, Ltd., at Bletchley, Bucks, etc. Directors: H. Cowley, G. Wilson, L. H. Cowley, F. N. Catlow and T. F. G. Wallis. Regd. office: 34-40, Bletchley Road, Bletchley, Bucks.

Home Electric Services (Bristol), Ltd.—Registered 13th June. Capital £100. Vendors, factors, agents and repairers of and dealers in washing machines, television and radio receiving sets, etc. Directors: E. Hinchliffe and Mrs. Jean Hinchliffe. Regd. office: 95, Lidget Street, Lindley, Huddersfield.

R.T.E. Electrics, Ltd.—Registered 20th June. Capital £1,000. Electricians, electrical contractors, etc. Directors: F. H. Merkl, Mrs. Jessie M. Merkl and E. V. Manners. Secretary: Mrs. J. M. Merkl. Regd. office: 20, Bloomsbury Square, London, W.C.1.

Liquidations

The London Battery & Cable Co., Ltd.—Winding up voluntarily. Liquidator, Mr. T. G. Threlford, Liverpool House, 15-17, Eldon Street, London E.C.2. Particulars of claims to the liquidator by 31st July.

C. Lewis (Devon), Ltd., radio and electrical contractors.—Last day for receiving proofs for dividend 23rd July. Liquidator, Mr. R. H. Passmore, 50, The Terrace, Torquay.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 3rd August:

MAGNASTRIPE (design). No. 761,576. Class 7. Electrically operated machines for imparting magnetic stripes or magnetic coating to tapes and films for use as sound recording media.—Photographic Electrical Co., Ltd., 71, Dean Street, London, W.1.

PRESTOR. No. 754,511. Class 9. Physical apparatus and chemical apparatus, all for scientific purposes; optical apparatus; electrotechnical apparatus; measuring, weighing, navigating and signalling apparatus; photocopying apparatus; cinematographic and radio apparatus, loudspeakers; and dictating machines, calculating machines and cash registers.—Veb Zeiss Ikon Dresden, Germany. Address for service, c/o Matthews, Hadden & Co., 31-32, Bedford Street, Strand, London, W.C.2.

FIBERLOY. No. 763,254. Class 9. Electric resistors.—Painton & Co., Ltd., Bembridge Drive, Kingsthorpe, Northampton.

VISTARAMA. No. 764,031. Class 9. Radio apparatus, television apparatus, sound recording and sound reproducing apparatus; and parts.—J. H. Wharton, trading as the Wharton Instrument Co., 1081, Finchley Road, London, N.W.11.

TETRAQ. No. 764,518. Class 9. Loudspeakers, sound recording and sound reproducing apparatus, sound amplifiers, radio receivers, transformers, and parts.—R.G.A. Sound Services (Plymouth), Ltd., 13, Grimstone Terrace, Houndiscombe Road, Mutley, Plymouth.

CHANCERY. No. 764,857. Class 9. Electric vacuum cleaning apparatus and parts.—Bylock Electric, Ltd., 109, South Street, Enfield, Middx.

GRAIL. No. 764,554. Class 11. Electric lamps.—L. & I. Clarke Electrical Co. (Portslade), Ltd., 49, Montpelier Road, Brighton.

LINAPOL. No. 763,992. Class 17. Insulating materials.—Ioco, Ltd., Netherton Works, Anniesland, Glasgow, W.3.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 24th July from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1952

16594. Standard Telephones & Cables, Ltd. (Bell Telephone Manufacturing Co., Soc. Anon.).—Telecommunication exchange systems. 26th June, 1953. (779521.)

23024. Neckar Water Softener Co., Ltd., and South Wales Switchgear, Ltd.—Electrical apparatus for controlling in a predetermined order the operation of a number of components. 21st October, 1953. (779522.)

1953

3111. Electric & Musical Industries, Ltd.—Electrode structures for electron-discharge devices. 21st January, 1954. (779549.)

4571. Siemens-Schuckertwerke Akt.-Ges. —Dry rectifier assemblies. 18th February, 1953. (779488.)

6650. Sperry Rand Corporation.—Electron discharge devices. 10th March, 1953. (779733.)

17034. Standard Telephones & Cables, Ltd.—Intelligence storage equipment. 11th June, 1954. (779651.)

21536. Minister of Supply, and Edison Swan Electric Co., Ltd.—Supports for thermionic valves. 4th August, 1954. (779578.)

22234. Morle, C. W. (Philco Corporation). —Cathode-ray tube systems. 12th August, 1953. (779579.)

22301. Electric & Musical Industries, Ltd. —Translation of X-ray images. 3rd August, 1954. (779699.)

23070. Siemens & Halske Akt.-Ges.— Wound electrical condensers. 21st August, 1953. (779892.)

23120. Haydon Switch, Inc.—Snap-action electric switches. 21st August, 1953. (779942.)

33885. Ferranti, Ltd.—Devices for controlling electromagnetic energy at high frequencies. 3rd March, 1955. (779453.)

35202. General Electric Co.—Control means for electric flatirons. 17th December, 1953. (779864.)

35511. Schmid, W. K.—Continuous electrical contact feeler control. 21st December, 1953. (779525.)

1954

772. Edison Swan Electric Co., Ltd.— Electron discharge devices. 6th January, 1955. (779758.)

6084. Central Electricity Authority (formerly British Electricity Authority) and Hodgkinson, A. J.—Water screening devices. 21st April, 1955. (779701.)

6629. Siemens & Halske Akt.-Ges.— Radiation measurement by means of a glow-discharge counter. 8th March, 1954. (779455.)

6655. Alkaline Batteries, Ltd.—Accumulator lamps. 8th March, 1955. (779737.)

7194. Boehme Fettchemie Ges.—Process for preventing the electrical charging of textile materials. 12th March, 1954. (779491.)

9453. Stone & Co. (Deptford), Ltd., J.— Windings for electromagnets. 25th March, 1955. (779639.)

10054. Mullard Radio Valve Co., Ltd.— Cold-cathode glow discharge counting and scaling tubes and circuit arrangements therefor. 7th March, 1955. (779526.)

10253. Tinsley (Industrial Instruments), Ltd., Steghart, F. L. F., and Cawthorne, C. W.—Electric automatic control systems. 24th March, 1955. (779654.)

11992. Automatic Electric Laboratories, Inc.—Telephone system using single-motion numerical switches. 26th April, 1954. (779833.)

15211. Cinema-Television, Ltd.—Electronic control circuits. 24th May, 1955. (779881.)

15212. Cinema-Television, Ltd.—High speed electronic counters. 24th May, 1955. (779882.)

15435. British Thomson-Houston Co., Ltd.—Sonic or ultra-sonic pulse echo locating systems. 19th May, 1955. (779658.)

16293. Fielden Electronics, Ltd. (formerly Fielden (Electronics), Ltd.).—Recording and/or indicating and/or control apparatus. 26th August, 1955. (Addition to 671389.) (779834.)

16706. Telefunken Ges. (formerly Telefunken Ges. für Drahtlose Telegraphie).— Travelling wave tubes. 8th June, 1954. (779583.)

18268. N. S. F., Ltd. (Oak Mfg. Co.).— High frequency apparatus. 22nd September, 1955. (779553.)

18515. Plessey Co., Ltd.—Control valves for fluid power transmission systems. 25th August, 1955. (779554.)

19485. Siemens Bros. & Co., Ltd.—Electric selective signalling systems. 23rd December, 1955. (Addition to 721683.) (779899.)

19797. Goldstaub, H. H.—Means for retaining electronic valves in position. 5th July, 1955. (Addition to 629229.) (779944.)

22012. Electric & Musical Industries, Ltd. —Colour television. 22nd July, 1955. (779457.)

24551. Wolff, H. W.—Electric circuit-breakers. 23rd August, 1955. (779624.)

26968. Cator, W. S.—Electric multi-contact plug and socket couplings. 14th September, 1955. (779946.)

28371. General Electric Co.—Electric flatirons. 1st October, 1954. (779865.)

28549. Hoover, Ltd.—Washing machines. 30th September, 1955. (779584.)

28665. Metropolitan-Vickers Electrical Co., Ltd.—Blown discharge gap switch. 4th October, 1955. (779585.)

29394. General Electric Co.—P-N junction devices and their methods of manufacture. 12th October, 1954. (779666.)

32766. Neale & Sons, Ltd., J., and Neale, M. R.—Electric rear lamps for road vehicles. 1st December, 1955. (779789.)

33830. Wolff, H. W.—Electric cable terminals. 23rd November, 1955. (779625.)

33831. Wolff, H. W.—Thermal magnetic overload units. 23rd November, 1955. (779626.)

34110/1. Murphy Radio, Ltd.—Radar and like apparatus. 24th November, 1955. (779886/7.)

34812. Philips Electrical Industries, Ltd. —Transistor circuit arrangements. 1st December, 1954. (779884.)

34937. Morle, C. W. (Philco Corporation). —Heterodyne frequency converters. 2nd December, 1954. (779910.)

35107. British Thermostat Co., Ltd.— Fluid metering devices. 23rd November, 1955. (779612.)

36224. British Telecommunications Research, Ltd.—Inductors for use in light current electrical circuits. 29th November, 1955. (779559.)

37511. Plessey Co., Ltd.—Electromagnetic actuating mechanisms or relays. 29th December, 1955. (779951.)

1955

1343. Williams, W. J.—Multiple electric switch speed controlled mechanism. 17th January, 1955. (779676.)

1551. Compagnie Générale d'Electricité. —Injection presses for restoring the insulation of parallel juxtaposed electric conductors. 18th January, 1955. (779677.)

1871. Goodyear Tire & Rubber Co.— Electronic d.c. amplifier. 21st January, 1955. (779792.)

2254. Hercules Powder Co.—Insulated electrical conductors. 25th January, 1955. (779613.)

2345. Philips Electrical Industries, Ltd.— Tubular electric incandescent lamps. 26th January, 1955. (779460.)

3457. Müller, W.—Electric condenser. 4th February, 1955. (779794.)

3597. Hochmayer, F.—Electrically heated percolator for preparing coffee, tea or the like. 7th February, 1955. (779617.)

4481. Oak Mfg. Co.—Electric switches with inter-engaging contacts. 15th February, 1955. (779956.)

5745. Wolsey Television, Ltd.—Aerials. 13th December, 1955. (779586.)

6789. Philips Electrical Industries, Ltd.— Electron lenses. 8th March, 1955. (779462.)

7626. Fulham, L. F.—Electrical heaters for steering wheels. 31st August, 1956. (779918.)

8820. Stone & Co. (Deptford), Ltd.— Windings for electromagnets. 25th March, 1955. (Divided out of 779639.) (779640.)

10667. Bendix Aviation Corporation.— Winding of stator coils. 13th April, 1955. (779618.)

12154. Western Electric Co., Inc.—Magnetic switching circuits. 27th April, 1955. (779843.)

13237. Siemens-Reiniger-Werke Akt.-Ges. —Two-way ultra-sonic devices with electro-acoustic transducers. 6th May, 1955. (779684.)

13759. Mallory & Co., Inc., P. R.—Electrolytic capacitors. 12th May, 1955. (779799.)

13915. S.E.C.I. Soc. Elettrotecnica Chimica Italia, and Canegallo, G.—Method of manufacturing resistors protected with a moulded coating of plastic insulating material. 13th May, 1955. (779587.)

13918. Standard Telephones & Cables, Ltd.—Colour television apparatus. 13th May, 1955. (779564.)

14588. Clevite Corporation.—Direct-coupled amplifier. 20th May, 1955. (779963.)

14602. Standard Telephones & Cables, Ltd.—Colour television receiver. 20th May, 1955. (779467.)

16735. Columbia-Southern Chemical Corporation.—Electrolytic cells. 10th June, 1955. (779928.)

18698. General Electric Co.—Electro-mechanical transducer systems. 28th June, 1955. (779801.)

25046. Siemens-Reiniger-Werke Akt.-Ges.—Supersonic devices for measuring workpieces. 31st August, 1955. (779690.)

25733. General Motors Corporation.— Thermostats. 8th September, 1955. (779593.)

25931. Siemens & Halske Akt.-Ges.— Electromagnetic moving armature devices. 9th September, 1955. (779974.)

37108. Warmex, Ltd., and Goldstein, A. —Electric heaters. 6th January, 1956. (779520.)

5083. Mullard Radio Valve Co., Ltd.— Magnetic core circuit arrangements. 17th February, 1956. (779780.)

8323. British Thomson-Houston Co., Ltd.—Electromagnetic pumps. 16th March, 1956. (Addition to 698521.) (779545.)

9131. Western Electric Co., Inc.—Communication system switching networks. 23rd March, 1956. (779984.)

12794. Eaton Manufacturing Co.—Electromagnetic coupling device. 26th April, 1956. (Addition to 743400.) (779484.)

30877. Philips Electrical Industries, Ltd. —Transistor circuit arrangements for simulating a variable electric resistance. 1st December, 1954. (Divided out of 779884.) (779885.)

1957

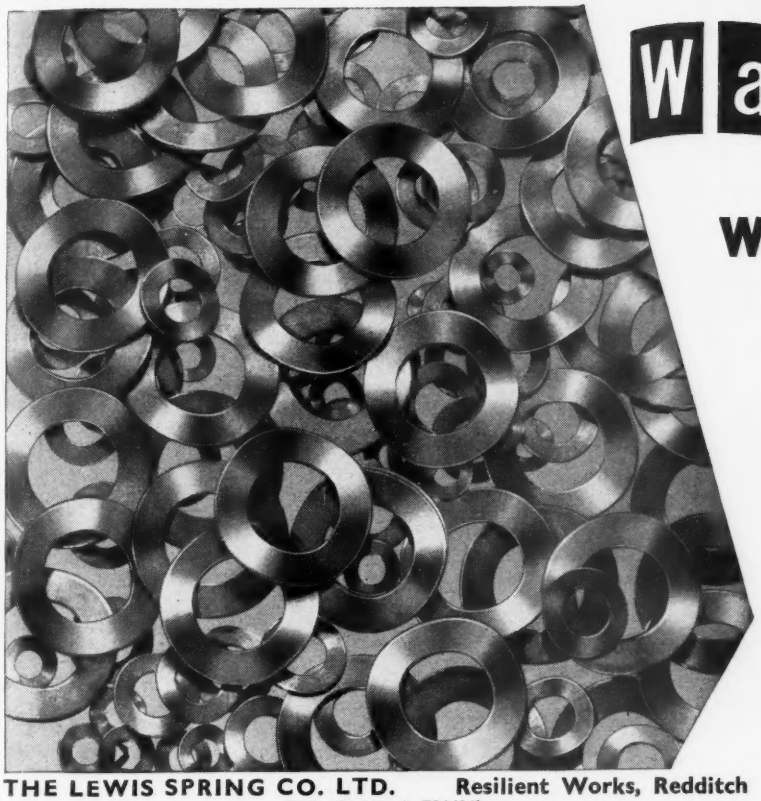
11027. Sperry Rand Corporation.—Electron discharge devices. 10th March, 1953. (Divided out of 779733.) (779985.)

Amended Specifications Published

647962. Brush Development Co.—Magnetic recording and reproducing apparatus.

652337. Electrolux, Ltd.—Centrifugal fans.

742331. Standard Telephones & Cables, Ltd.—Terminating arrangements for armoured electric cables particularly suitable for submarine cable repeater housings.



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Beryllium Copper "Wavey" Washers. For Electronic Components. Range 8BA to ½. Corrosion resisting, non-damaging to components, higher resistance of "set", higher recovery of load, permanent spring action. They are fabricated from Beryllium copper, heat treated to VPN.350 minimum, Electro Plated to DTD.924, Cadmium Plated to DTD.904 and Passivated to DTD.923. Samples and price lists on request.

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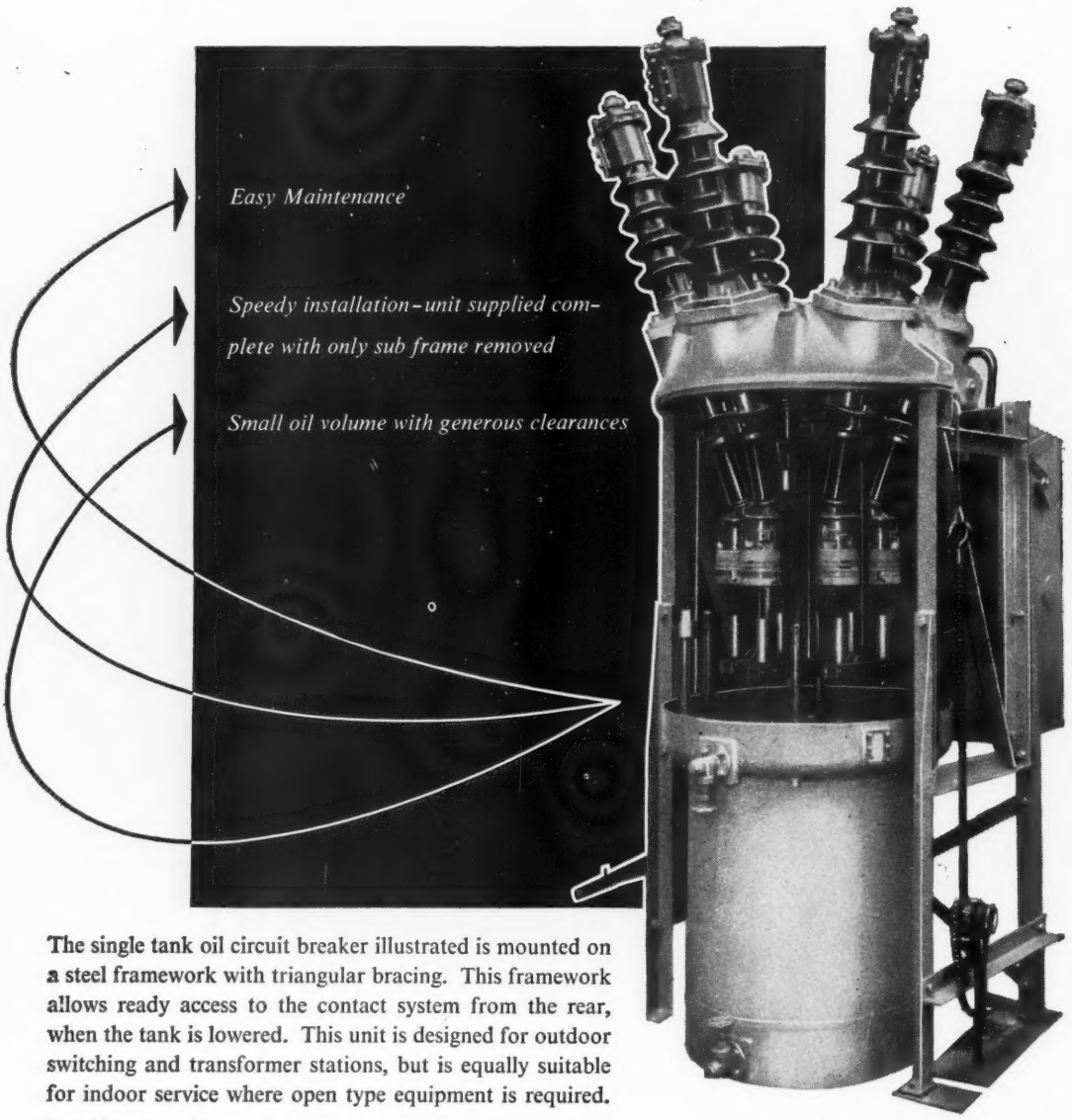
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Small oil volume with generous clearances

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1000 MVA at 33 kV and 44 kV.
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CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Snowy Mountains Hydro-Electric Authority. 13th August. Two control desks for power stations. (E.S.B. 16955/57. Ten/26881.)*

Electricity Commission of New South Wales, Sydney. 19th August. One 6 MW water-driven turbo-alternator. (E.S.B. 16957/57. Ten/26857.)*

G.P.O., Melbourne. 29th August. Ringing generators. (E.S.B. 16196/57. Ten/26816.)*

Belgium.—Brussels Electricity Department. 26th July. Fluorescent tubes. (E.S.B. 16596/57. Ten/26790.)* Tubular masts and fluorescent lighting tubes. (E.S.B. 16595/57. Ten/26814.)*

Blackpool.—Corporation. 21st August. Street lighting equipment. (See this issue.)

Cleethorpes.—Corporation. 30th July. Electrical installations in a housing scheme. (See this issue.)

Dagenham.—31st July. Borough Council. Two electrical delivery pumps. Borough surveyor, Civic Centre.

Durham.—County Council. Electrical installations in schools. (See this issue.)

Formosa.—Central Trust of China, Taipei. 5th August. Electric furnace and drying ovens. (E.S.B. 16457/57.I.C.A. Ten/26732.)*

India.—Mysore Stores Purchase Committee, Bangalore. 12th August. Conductor and accessories. (E.S.B. 16582/57. Ten/26770.)* Induction motors and allied materials. (E.S.B. 16583/57. Ten/26768.)*

Government of Madras. 29th July. Ground cable and accessories. (E.S.B. 16787/57. Ten/26828.)*

National Coal Development Corporation (Private), Ltd., Calcutta. 9th August. One 15 kVA oil circuit-breaker with lighting transformer. (E.S.B. 16914/57. Ten/26868.)*

Iraq.—Development Board and Ministry of Development. 2nd December. Boiler feed and auxiliary service pumps for Basrah power station. (E.S.B. 17048/57. Ten/26913.)*

Manchester.—City Council. 6th August. Electrical installations at Briscoe Lane Primary School. (See this issue.)

New Zealand.—Post and Telegraph Department, Wellington. 5th August. Microphone connectors, plugs and sockets. (E.S.B. 16586/57. Ten/26818.)*

Rhodesia and Nyasaland.—Federal Tender Board, Causeway. 25th July. Electric cookers. (E.S.B. 16906/57. Ten/26888.)*

Sedgley.—U.D.C. Street lighting equipment. (See this issue.)

South Africa.—Union Tender and Supplies Board, Pretoria. 22nd August. Transmitters, receivers, drives, telephone terminals, band displacements. (E.S.B. 16546/57. Ten/26776.)* Error correcting radio telegraph equipment. (E.S.B. 16544/57. Ten/26783.)* 15th August. Lead covered polythene dielectric coaxial cable. (E.S.B. 16543/57. Ten/26755.)* 12th August. A.f. amplifiers. (E.S.B. 17236/57. Ten/26509.)*

Stores Department, South African Railways, Johannesburg. 2nd August. Suspension insulators. (E.S.B. 16813/57. Ten/26836.)* 16th August. Electric furnaces and electrically heated tinning baths. (E.S.B. 16566/57. Ten/26759.)* 9th August. Telegraph pole bases. (E.S.B. 17156/57. Ten/26902.)*

Cape Provincial Administration. X-ray unit and diathermy apparatus. (E.S.B. 16608/57. Ten/26837.)*

Spain.—Hidroelectrica del Cantabrico, S.A., Madrid. 31st July. Circuit-breakers and transformers. (E.S.B. 16751/57. Ten/26808.)*

United States.—Power Authority of the State of New York. 15th August. Thirteen 167,000 kVA generators. (E.S.B. 16662/57. Ten/26869.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Durham.—County Education Committee. Accepted. Electrical work in schools: Peterlee Dene House County Junior School (£1,997).—Gray Brothers, Ltd. Stockton Technical College (£387).—J. Paterson & Co. Ferryhill Station County School (£1,271).—C. Horne and Co. Newton Aycliffe County Junior School (£1,922).—Cox-Walkers, Ltd.

Felling (Durham).—U.D.C. Accepted. Concrete lighting columns and equipment for Shields Road (£1,952) and High Heworth Lane (£257), Felling.—Concrete Utilities, Ltd.

Gosport.—Corporation. Recommended. Installation of sodium lighting in 19 roads as the first stage of a five-year programme (£17,592).—Southern Electricity Board.

Luton.—Corporation Education Committee. Recommended. Electrical services for the new building scheme for the College of Further Education (£22,888). — David Thomson (Luton), Ltd.

Middlesbrough.—Corporation. Recommended. Street lighting at the Easterside housing development (£7,027). — North Eastern Electricity Board.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aldridge.—Dwellings (260), Leighswood estate; J. Mason, surveyor, 9, Leighswood Road.

Ashington.—Technical College (second instalment) for Northumberland C.C. (£430,000); county architect, County Hall, Newcastle-on-Tyne.

Barnes.—Houses (216), on sites at Westfields and West Hall Road; borough engineer, Municipal Offices, Sheen Lane, East Sheen, S.W.14.

Belfast.—Dwellings (377), Victoria Barracks development scheme. College of Domestic Science, Old Holywood Road/Garnerville Road site; city surveyor, City Hall.

Berkshire.—County junior school at Clewer Manor (£59,355); county architect, Wilton House, Parkside Road, Reading.

Billingham-on-Tees.—Cinema for Circuits Management Association, London; L. D. Paterson, architect, Regent Street, Glasgow.

Blaydon (Co. Durham).—Houses (240) at Winlaton for the U.D.C.; direct labour.

Boldon (Co. Durham).—Houses (198) at Boldon Lane, Cleadon; W. Leech, Ltd., builders, 2, Clayton Street, Newcastle-on-Tyne.

Brighton.—Four-storey offices, 1 and 2, Duke Street; Legal and General Assurance Society, Ltd., 32, West Street.

Brooklands.—Assembly hall, teaching, laboratory, workshop and administrative accommodation at the Technical College (£181,120), for County E.C.; county architect, County Hall, Kingston-on-Thames.

Caernarvon.—Houses (188) on the Bryn and Ty Gwyn housing site; J. Isgoed Williams, architect to T.C., Richmond House, Penmaenmawr.

Cheltenham.—Works, Tewkesbury Road; Grimshaw, Kinnear, Ltd., 111, Promenade.

Chester.—Houses (164), Newton Hall estate; city surveyor, 43, Northgate Street.

Five barrack blocks, etc., at Eaton Hall Officer Cadet School (£220,000), for the War Office; H. Anthony Clark and F. C. Roberts, architects, 41, Regent Street, Wrexham.

Chesterfield.—Houses (52), Heath, and houses (41), Tupton; J. B. Wikeley, R.D.C. surveyor, Saltergate.

Crayford.—Works; Pressure Lubricants, Ltd., Cray Avenue, St. Mary Cray.

Crewe.—Extensions to Cheshire County Training College (£82,560), for E.C.; director of education, City Road, Chester.

Dewsbury.—Houses (100), Black Horse estate, and houses (70), Spen Valley estate; borough engineer, Municipal Buildings, Halifax Road.

Dulverton.—Secondary Modern School; Somerset county architect, Park Street, Taunton.

Durham.—Proposed R.C. school at Gilesgate Moor (£45,000); A. Rossi, architect, 15, Melbourne Street, Consett.

Easington.—Houses (149) at Murton for the R.D.C.; direct labour.

Eastleigh.—Houses and bungalows (60), Velmore housing estate, Stage 11; Roland J. Roddis, town clerk, Town Hall.

Epworth.—Secondary modern school for Lindsey C.C. (£148,284); county architect, Lincoln.

Essex.—Firemen's houses at Waltham Abbey (£30,000), and at Dovercourt (£20,000), for Fire Brigade Committee; H. Conolly, county architect, County Hall, Chelmsford.

Evesham.—Houses (65), Laurels Road, Offenham; R.D.C. surveyor, Council Offices, Lansdowne, Port Street.

Exeter.—Omnibus station, maintenance and repair depot, Sidwell Street/Paris Street site; Devon General Omnibus and Touring Co., Ltd., Head Office, Newton Road, Torquay.

Greenford.—R.C. special school; David Stokes & Partners, architects, 5, Cochrane Street, London, N.W.8.

Halesowen.—Flats and maisonnettes (52), Highfields, four shops and maisonnettes and 10 houses on the Fatherless Barn estate; A. Basterfield, town clerk.

Hemel Hempstead.—Secondary school at Warners End (£230,543), for County E.C.; county architect, County Hall, Hertford.

High Wycombe.—Dwellings (54), Castlefield estate; G. A. Griffiths & Sons, builders, Verney Avenue.

Houghton-le-Spring. — Alterations and additions to bus depot at Philadelphia for Sunderland District Bus Co.; R. C. Cowmeadow, architect, Churcham, Gloucester.

Irlam.—Houses (50), Glaze estate, Cadishead; U.D.C. surveyor, Clarendon Road, Irlam, near Manchester.

Kingston-on-Thames.—Additions to Kingston School of Art, including library and technicians' workshop (£97,500), for E.C.; county architect, County Hall.

Kirkham.—Houses (226), Millbank estate; U.D.C. surveyor, Moor Street.

Leicester.—Work to start in autumn on new chemistry block for Leicester University as part of 10-year extension scheme on a 9-acre site; architect, Professor L. Martin, Cambridge University.

London.—Seven-storey offices on site of St. James's Theatre, King Street, S.W.1 (£200,000); Robin Seifert, architect, 28, Great Ormond Street, London, W.C.1.

Offices and laboratories, Neasden Lane; G. & E. Bradley, Ltd., Beresford House, Mount Pleasant, Wembley.

Flats (50) and houses (100), Abbotsbury Road, Kensington; Stone, Toms & Partners, architects, 28, South Audley Street, W.1.

Newcastle-on-Tyne.—Bottling factory and warehouse, George Street, for J. Storey and Son; H. Gatoff, architect, 51, Grainger Street.

Department of Metallurgy for King's College; Stephen Easten, Ltd., builders, Westgate Road.

New Southgate.—Flats (100), site at rear of Palmers Road, for B.C.; David du R. Aberdeen, architect, 19, Southampton Place, London, W.C.1.

Newton Aycliffe (Co. Durham).—Houses (85), for Aycliffe Development Corporation; G. A. Goldstraw, chief architect.

Oxford.—Flats (84), Elsfield Way South; city architect, Town Hall.

Oxfordshire.—Secondary modern school, Thame (£98,736), secondary school, Henley (£85,000), extensions to Henley Grammar School (£40,000), and primary school, Bampton (£29,645); county architect, County Hall, Oxford.

Paisley.—Six blocks of 15-storey flats; burgh surveyor.

Peterborough.—Houses (144), Gunthorpe estate; city surveyor.

Poole.—Three-storey offices; Whitelock & Co., Ltd., building contractors, 218, Bournemouth Road, Branksome, Bournemouth West.

Prudhoe (Northumberland).—Houses (366) at West Wylam for the U.D.C.; G. Wimpey and Co., Ltd., contractors, Fenwick Terrace, Newcastle-on-Tyne.

Rotherham.—Houses (224), Kimberworth Park estate; John S. Wall, town clerk, Municipal Offices.

St. Albans.—College of Further Education in Hatfield Road (£376,098), for County E.C.; county architect, County Hall, Hertford.

Saltburn.—Houses (100) and ten bungalows at Marske for the U.D.C.; Readman and Skelton, builders, Marton, Middlesbrough.

Scunthorpe.—Foxhills Secondary Modern School for Lindsey C.C. (£81,465); county architect, Lincoln.

Sheffield.—New police headquarters on the Lambert Street/Scotland Street/West Bar Green site; J. L. Womersley, city architect, Town Hall, 1.

Smethwick.—Extensions, Chance Technical College; W. W. Atkinson, architect, 4, Verulam Buildings, Gray's Inn, London, W.C.1.

South Shields.—Houses (51) at Ravensworth Terrace for the T.C.; William Leech, Ltd., builders, 2, Clayton Street, Newcastle-on-Tyne.

Southampton.—Houses (71) on sites at Thornhill and Sydney House; borough engineer, Civic Centre.

Southgate.—Flats (100), Palmers Road; David du R. Aberdeen, architect, 19, Southampton Place, London, W.C.1.

Stamford.—Central laundry at Stamford and Rutland Hospital (£50,315); East Anglian Regional Hospital Board, 117, Chesterton Road, Cambridge.

Stanley (Co. Durham).—Houses (107) at Tanfield Lea and 147 at Wesley Terrace, Annfield Plain, for the U.D.C.; J. R. Heslop, surveyor.

Stockton-on-Tees. — Factory, Maritime Street, for Activity Textiles, Ltd., underwear manufacturers, 26, Sackville Street, London, W.1.

Sturton-by-Stow. — Secondary modern school for Lindsey C.C. (£117,414); county architect, Lincoln.

Swansea. — Factory extension; Servitor Brush Co., Ltd., Trading Estate, Fforestfach.

Thornaby-on-Tees.—Houses (124), Manfield Farm estate, for the T.C.; direct labour.

Tynemouth.—Houses (216); G. Wimpey & Co., Orchard House, Newcastle.

Fire station and ambulance station (£100,000); borough surveyor and architect, D. H. O'Herhily.

Urmston.—Four-storey block of Council offices; U.D.C. surveyor.

Uxbridge.—Agricultural unit at Harefield Secondary School; Middlesex county architect, 1, Queen Anne's Gate Buildings, London, S.W.1.

Wakefield.—Office block, Charlesworth Lane; E. Sheard & Sons, Ltd., Ings Road.

Wallsend.—Secondary technical school for Northumberland E.C. (£205,000); H. D. Burton, Ltd., contractors, King Street, North Shields.

Warwick.—Science laboratories, King's High School for Girls; Rayner & Fedeski, architects, 28, Parade, Leamington Spa.

Watford.—Twin operating theatre suite, Peace Memorial Hospital; C. D. Andrews, architect, Sheffield Street House, London, W.C.2.

Welwyn Garden City.—Factory; Crown Macaroni Co., 8, Broadwater Road.

Weybridge.—National College of Food Technology; Grenfell Baines & Hargreaves, architects, 12, Guildhall Street, Preston.

Whitley Bay.—Synagogue, Osborne Trust estate; Maurice Ison, promoter, Monkseaton Drive.

Wolverhampton.—Flats (253), in 11-storey block, Lower Stafford Street/ North Road site; J. Brock Allon, town clerk, Town Hall.

Wrexham.—Bungalows (80), for old people; R.D.C. surveyor, Imperial Buildings, Regent Street.

CATALOGUES AND LISTS

BRUSH UNIT.—Folder illustrating and describing the K.A.M. electrically driven conveyor belt brushing unit which is available with brush strips specially prepared for static collection and earthing, and in a flameproof type.—**Kleen-E-Ze Brush Co., Ltd.,** Hanham, Bristol.

CONDUIT FITTINGS.—27-page illustrated and priced catalogue (15) giving particulars of the "Blaco" range of conduit fittings.—**F. C. Blackwell & Co., Ltd.,** Great Crosby, Liverpool, 23.

ELECTRONIC EQUIPMENT. — Three leaflets dealing respectively with Model 6001 universal electronic batch counter, lumped constant delay networks and an encapsulated multi-ratio pulse transformer. — **Atkins, Roberts & Whiteford, Ltd.,** Industrial Estate, Thornliebank, Glasgow.

Catalogue illustrating and describing a range of electronic instruments including equipment for sound, noise and vibration measurement, non-destructive testing, stabilised power supplies, etc.—**A. E. Cawkell,** Victory Arcade, The Broadway, Southall.

Leaflet giving particulars of the T.C.B. series of batch counters and transistor machine controllers.—**Gate Electronics, Ltd.,** Tudor Grove, London, E.9.

FLAMEPROOF EQUIPMENT. — Folder illustrating and describing Buxton Certified cable glands, switched socket outlets and plugs and 15 A circular switches.—**Walsall Conduits, Ltd.,** West Bromwich, Staffs.

HEATING EQUIPMENT. — Illustrated descriptive brochure dealing with drum heaters to fit 15 and 45 gal drums and designed for the handling of paint, resins, bitumen and other viscous materials.—**Stabilag Co., Ltd.,** Mark Road, Hemel Hempstead, Herts.

LIGHTING FITTINGS. — Loose-leaf catalogue illustrating the company's range of "Tele-Aquarium" television lamps, wall lights, table lamps and illuminated flower plaques.—**Products K Blackpool,** Back St. Helier's Road, Blackpool, Lancs.

Illustrated folder on the "Kaydelite" range of contemporary lighting fittings.—**Kaydell Light Fittings,** Crowhurst Road, Hollingbury, Brighton, 6.

MAGSLIPS.—60-page publication (E-1000) entitled "Muirhead Magslips—Applications and Methods of Use," together with an illustrated folder dealing with the company's range of synchros and servo motors.—**Muirhead & Co., Ltd.,** Beckenham, Kent.

MEASURING INSTRUMENTS. — Descriptive brochure (E 11-13) on the company's strip chart telemeter recorder.—**Bailey Meters & Controls, Ltd.,** Purley Way, Croydon, Surrey.

Illustrated folder describing the BER 62 recording oscillograph, originally designed for seismic exploration but having applications in many fields of research, together with a brochure dealing with type EVS-2 seismic detectors.—**Seismic Instruments, Ltd.,** Granta Works, Cambridge.

MOTOR CONTROL GEAR.—12-page brochure (401) describing the company's "Unicube" range of medium voltage group control starter boards designed for heavy industrial service, together with a pamphlet surveying a range of switch and control gear for industrial use at home and abroad.—**M. & C. Switchgear, Ltd.,** Kirkintilloch, Glasgow.

OVENS.—Leaflet dealing with the company's range of electrically heated air circulating ovens designed for such processes as low temperature heat-treatment of light alloys, stove enamelling, core and mould drying, etc.—**G. W. B. Furnaces, Ltd.,** Dibdale Works, Dudley, Worcs.

PRINTED CIRCUITS.—Booklet on the use of Bakelite copper-clad laminates for printed circuits.—**Bakelite, Ltd.,** 12-18, Grosvenor Gardens, London, S.W.1.

RECTIFIERS.—Catalogues F/SRL 54 and F/RS 53 dealing with 10 mA tubular rectifiers and a combined rectifier-stabiliser for 1·4 V valves, together with data sheets on silicon junction low power rectifiers, a germanium junction power rectifier and a germanium junction photo-electric cell.—**Standard Telephones & Cables, Ltd.,** Rectifier Division, Harlow, Essex.

REFRIGERATOR.—Leaflet describing the Model S 13, 13 cu ft service cabinet designed for use by hoteliers, caterers, grocers and other commercial users.—**Lec Refrigeration, Ltd.,** Shripney, Bognor Regis, Sussex.

RESISTORS.—Catalogue dealing with high stability carbon resistors.—**Welwyn Electrical Laboratories, Ltd.,** Bedlington, Northumberland.

SIGNALLING EQUIPMENT.—Sixteen-page catalogue describing luminous signalling and indicating equipment for installation in hospitals, hotels and ships.—**Gent & Co., Ltd.,** Faraday Works, Leicester.

TRANSFORMERS. — Three illustrated catalogues (DB 5/4, DB 10/4 and DB 16/1) dealing respectively with forced cooled transformers, naturally cooled distribution transformers and small low voltage transformers.—**Hackbridge & Hewittic Electric Co., Ltd.,** Walton-on-Thames, Surrey.

15-page descriptive catalogue on the "Variac" range of regulating transformers.—**Zenith Electric Co., Ltd.,** Zenith Works, Villiers Road, Willesden Green, London, N.W.2.

VIBRATING EQUIPMENT.—Brochure (11/AA1) describing the "Locker" electric vibrating feeders, conveyors and screens manufactured by the company.—**Lockers (Engineers), Ltd.,** Warrington.

VOLTAGE REGULATORS. — 32-page catalogue (S-574) covering automatic voltage regulators and stabilisers.—**Claude Lyons, Ltd.,** Valley Works, Ware Road, Hoddesdon.

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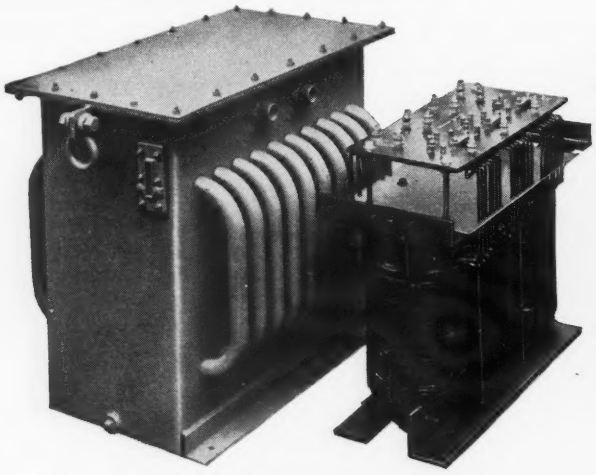

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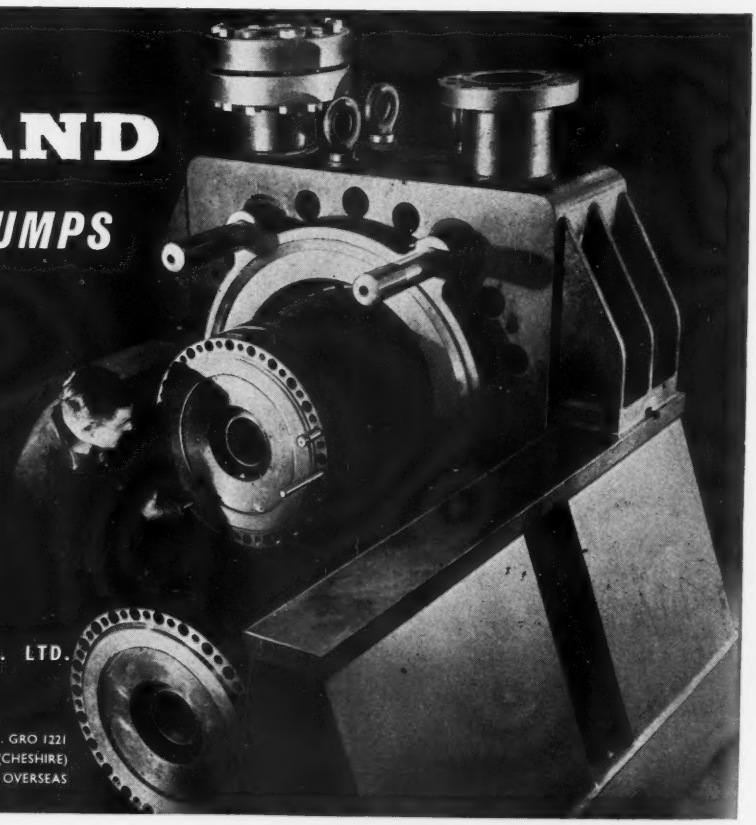

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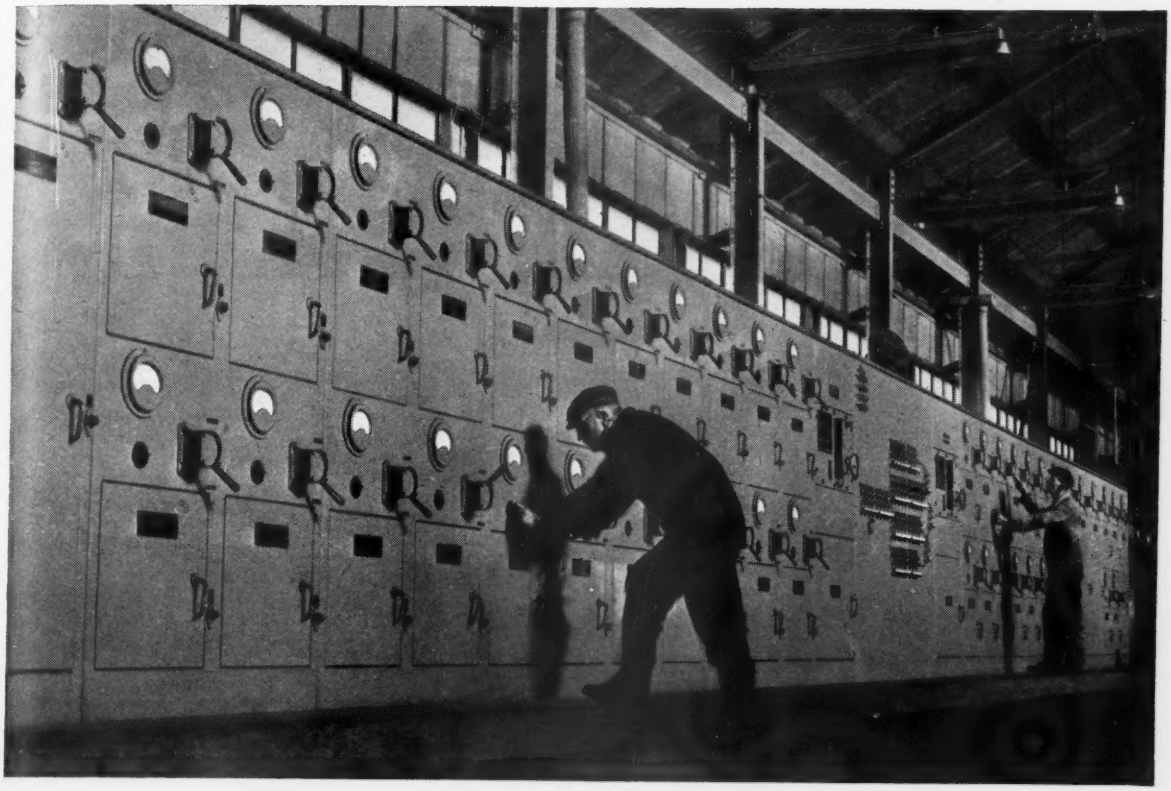

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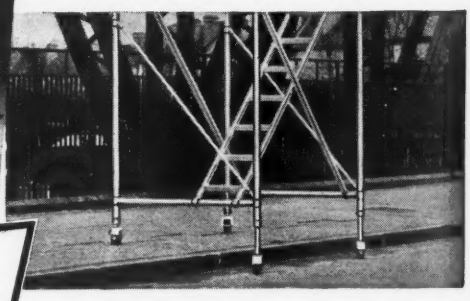

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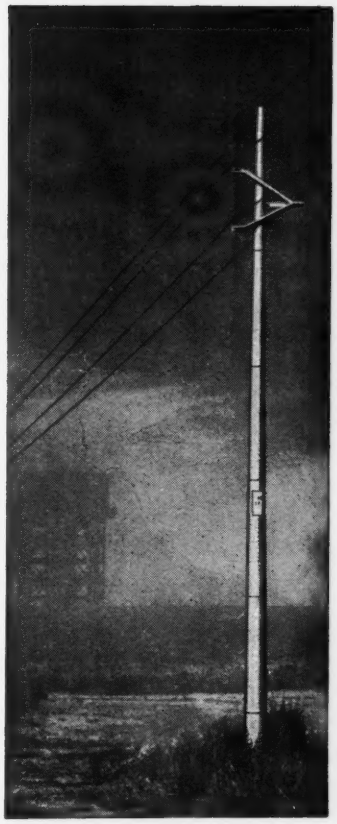

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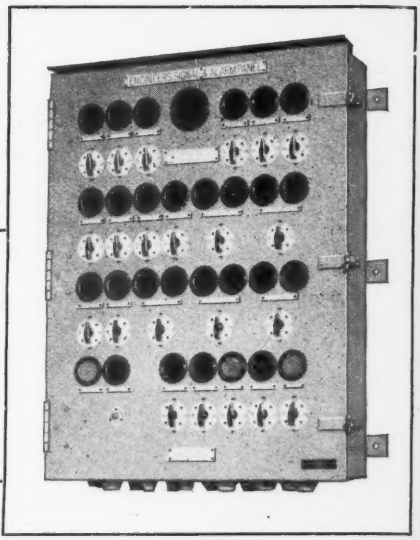

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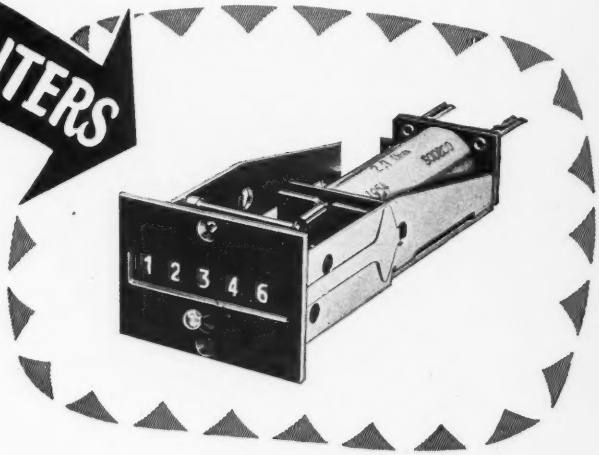

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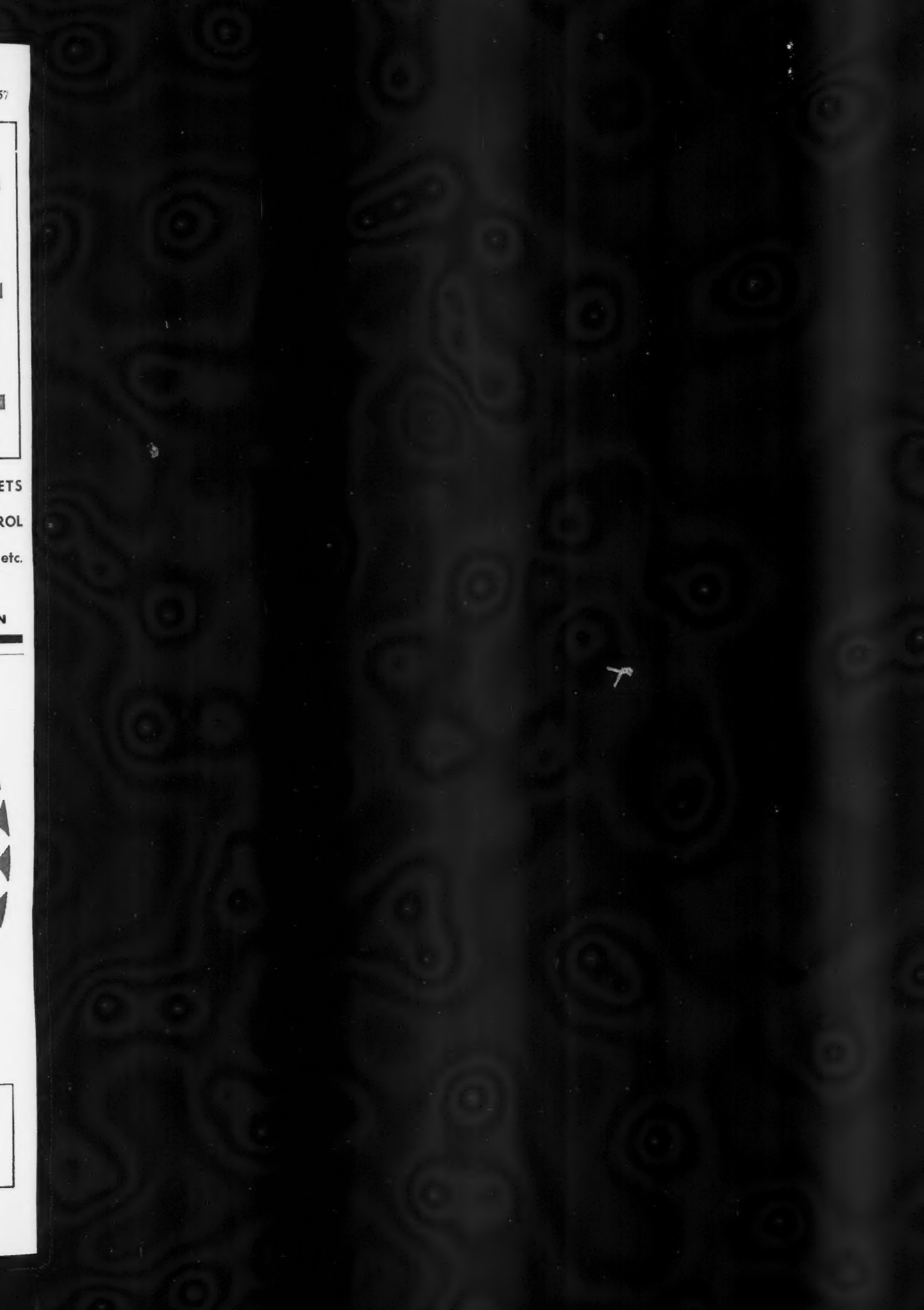

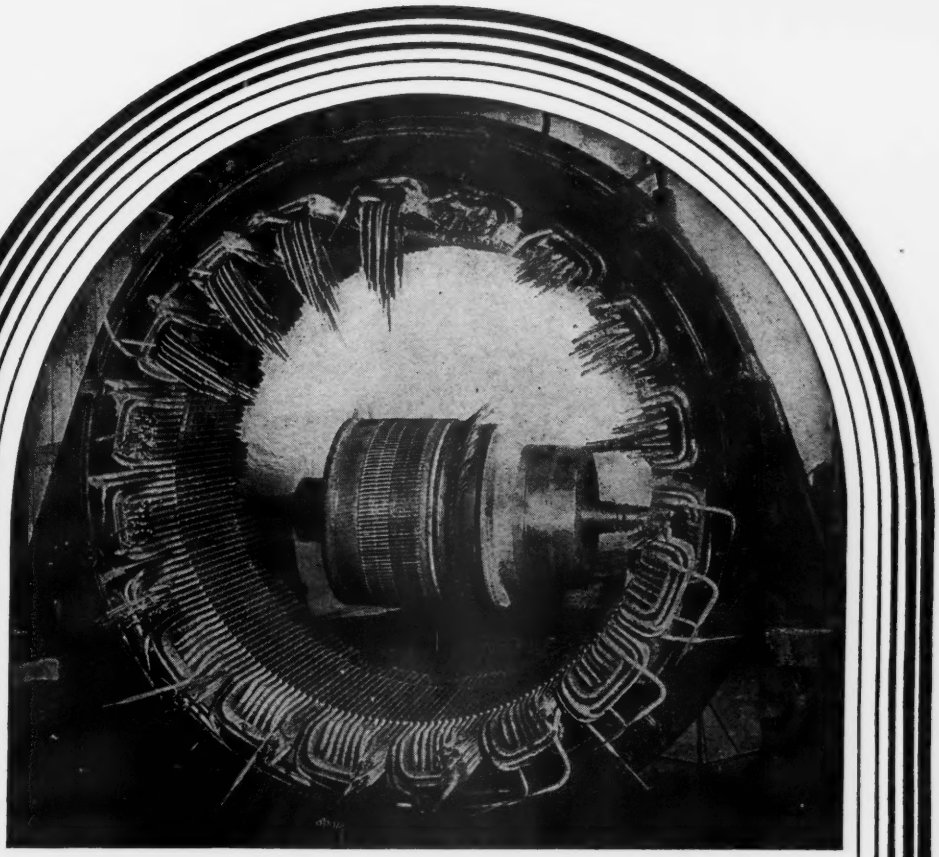

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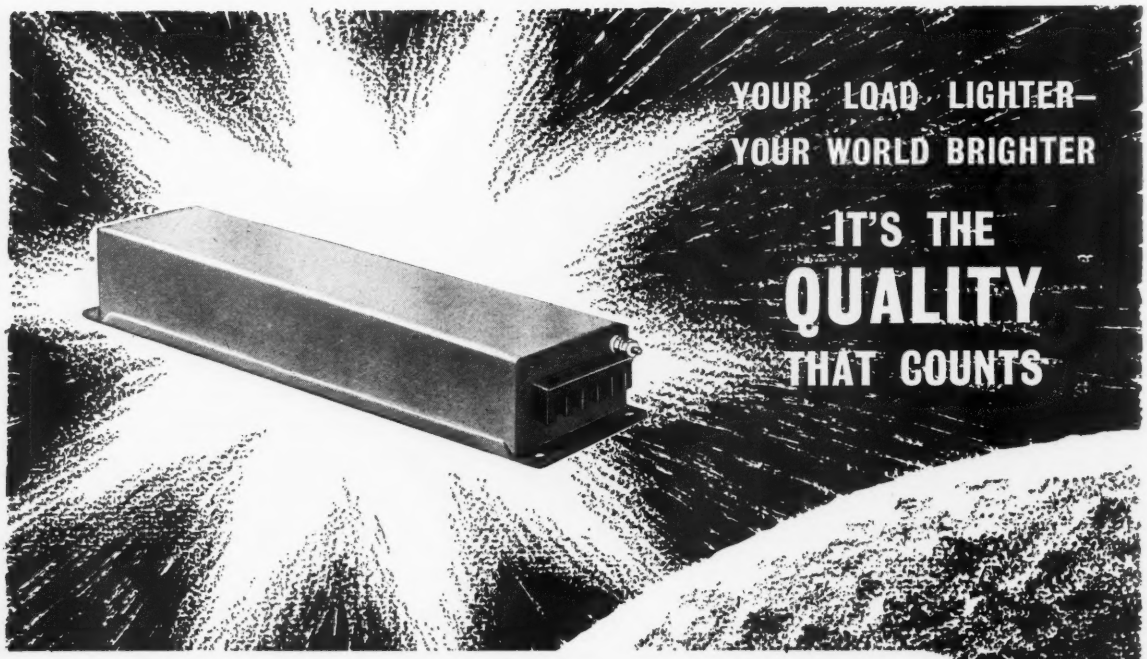

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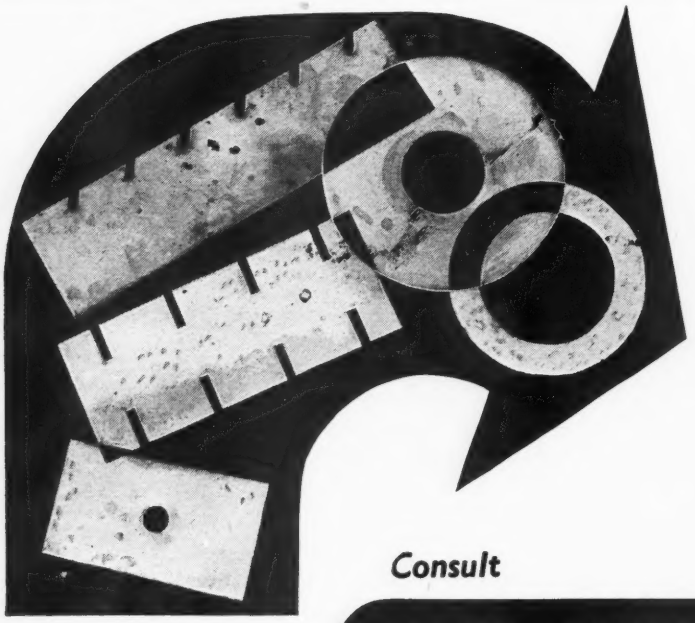

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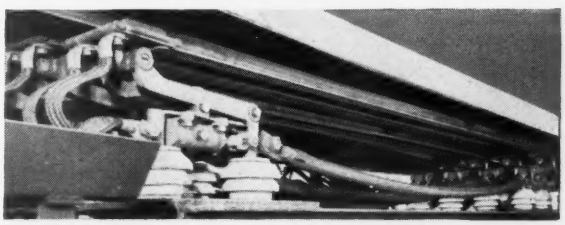

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THE MERCURY SWITCH MANUFACTURING COMPANY LIMITED are the largest specialised manufacturers of Mercury Switches in Great Britain. These are made to exceptionally high and uniform standards of quality.
Since its inception in 1932, this Company has concentrated solely on the production of Mercury Switches. It has thereby obtained the widest possible experience and expert knowledge of design, manufacture and application.

THE MERCURY SWITCH MANUFACTURING CO. LTD.
WEST DRAYTON - MIDDX.

MS11

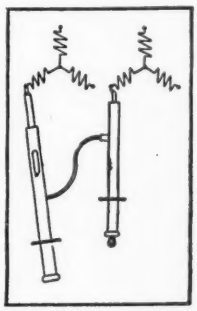
Is It Alive?

'WESTMINSTER' PATENT VACUUM TUBE DETECTORS

WILL SHOW

Visible indication on contact with a live conductor, or in case of high voltages as soon as Detector approaches and before contact is made.

Range 2,000 to 35,000 volts.



'WESTMINSTER' PHASING RODS
To locate interconnections between two A.C. systems.

'PARTRIDGE' PRESSURE DETECTORS
Give visible and audible indication of whether lines and contacts of draw-out switchgear are alive or dead.

NO EARTH CONNECTION REQUIRED

Write for full details to sole manufacturers:

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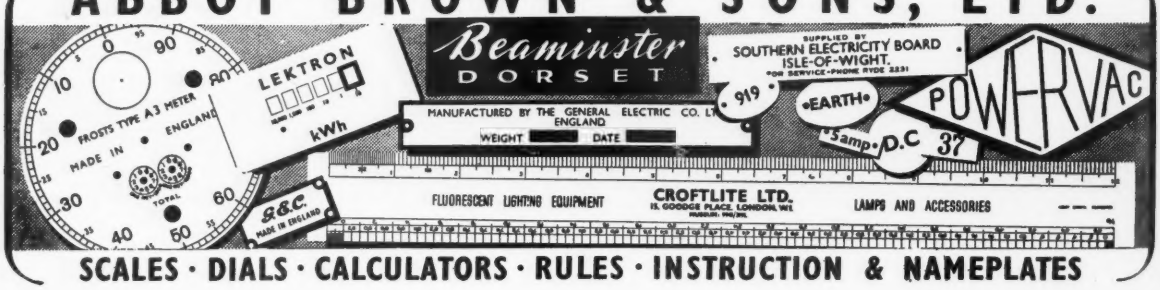
ABBOT BROWN & SONS, LTD.



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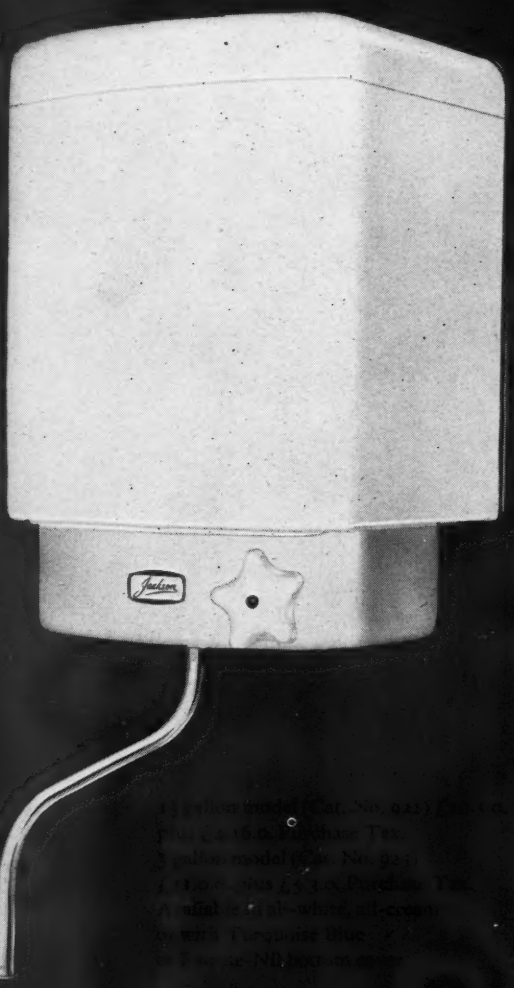
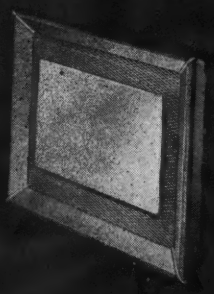
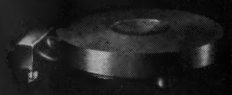
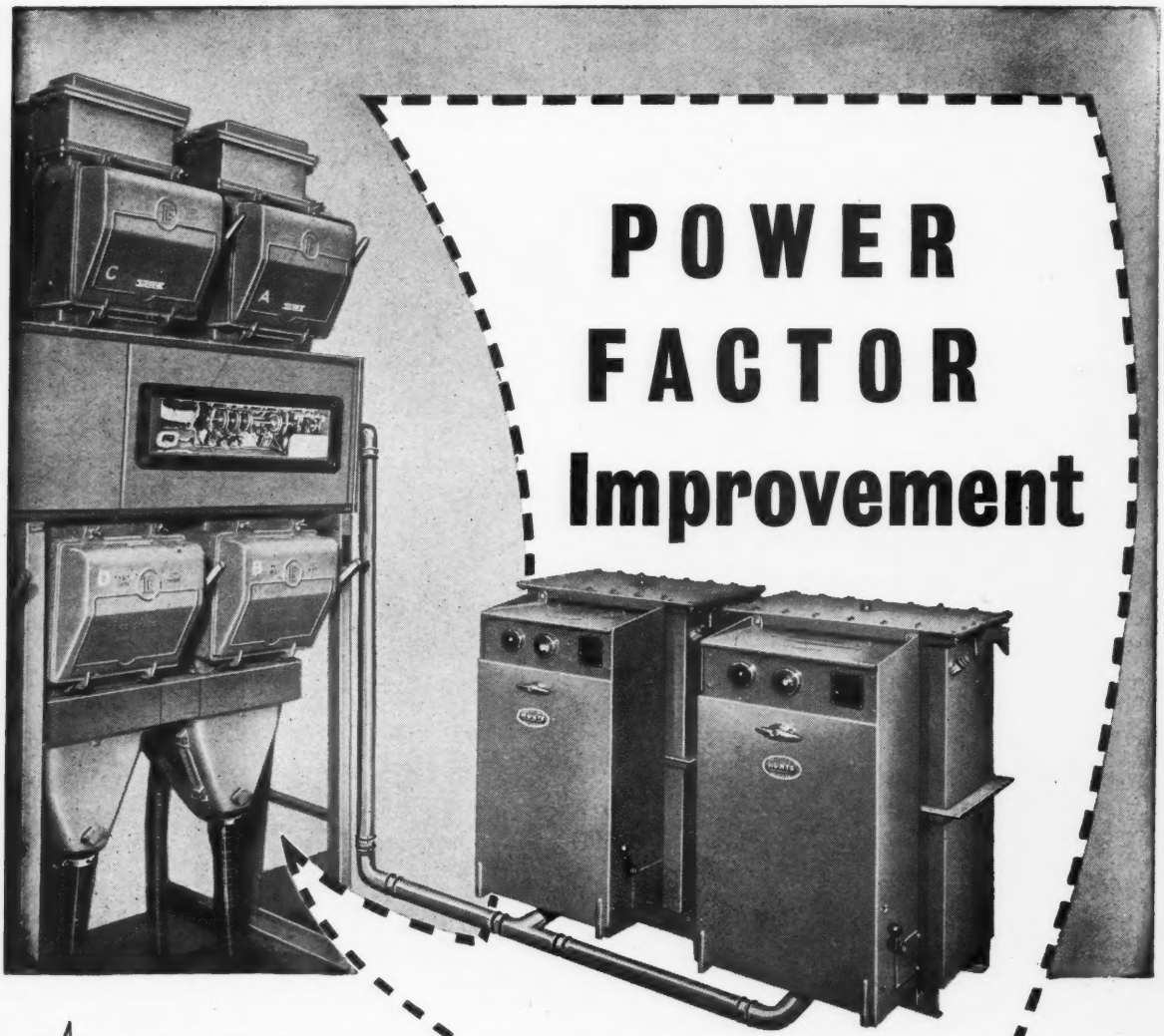






For satisfaction — sell them Jackson



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You are invited to discuss your Power Factor problem with our technical staff.

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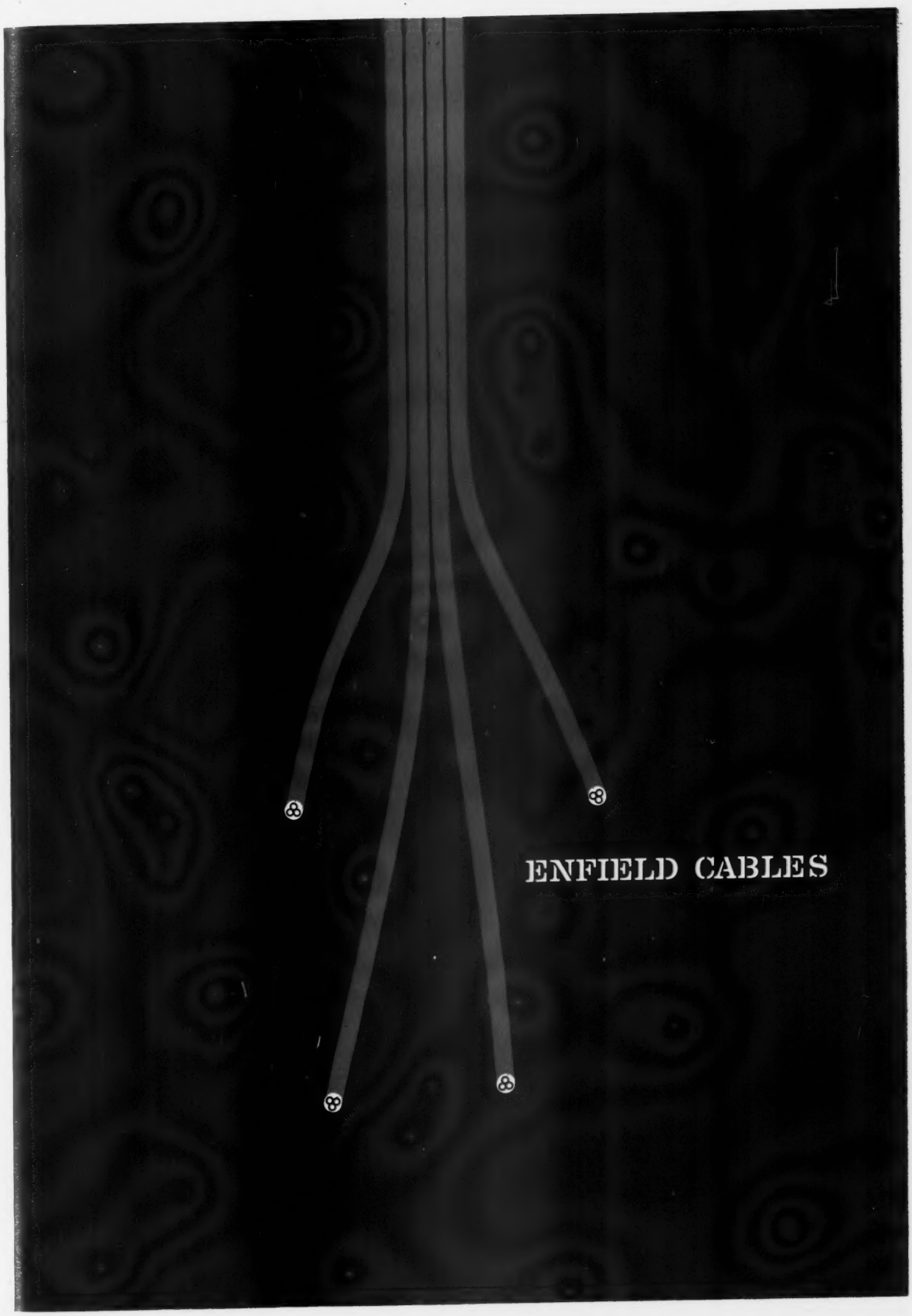
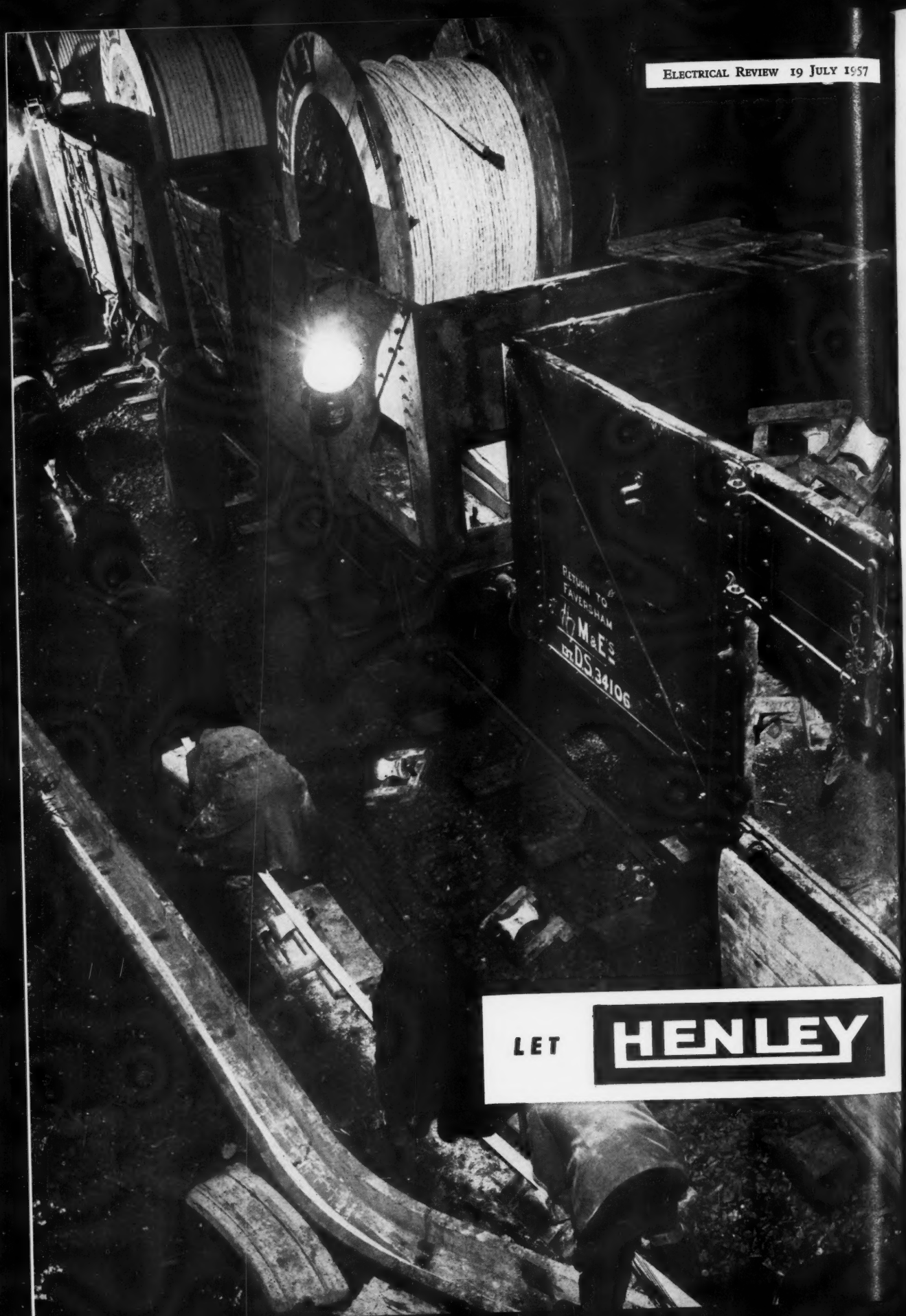

ENFIELD CABLES



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For the Kent Coast Electrification Scheme

The first lengths of Henley Cables being laid at midnight for the Kent Coast Electrification Scheme of the British Railways Southern Region.

With the pilot cable already in the trough, the 33 kV 3-core oil-filled cable is hauled off the cable train prior to pulling through the ducts at Twydall Crossing, near Gillingham, Kent.

With their wide experience of railway electrification, Henley's are proud to have received this £¾ million contract as part of the modernization of British Railways.

CABLES CARRY THE CURRENT

BY APPOINTMENT TO HER MAJESTY THE QUEEN ELECTRIC CABLE MANUFACTURERS

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THE THERMOSTATIC CONTROLS CO.

WE shall be pleased to submit special designs for all domestic and commercial applications, including combination units of heater and thermostat, or safety device.

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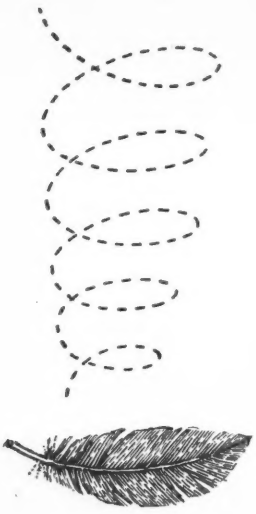

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When you reduce noise and vibration you increase efficiency, the efficiency of your workers and of your machines, because vibration wears out machines, too.

The Croid-Cooper method holds your machines firmly on a felt base, with an adhesive power of 50 lbs to the square inch, yet you can change your layout overnight because there's no bolting and grouting with Croid-Cooper. And no damaged floors, either. More than 1,000 factories now use the Croid-Cooper method. May we send you details ?

Just four strips of Cooper's MG Felt and some Croid '65' Machine-fixing Glue gives you a firm installation in twelve hours with a holding power of 50 lbs to the square inch.

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CROID 65
MACHINE FIXING GLUE
COOPERS
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ASTA certified

The Association of Short-Circuit Testing Authorities (ASTA) issues Certificates of Rating for fuses giving satisfactory performance when tested in accordance with the appropriate clauses of British Standard 88.

The following ASTA Certificates have been issued to cover the complete range of 'ENGLISH ELECTRIC' Type 'T' Cartridge Fuse Links.

ASTA CERTIFICATE NUMBERS

RATING AMPS	LIST NOS.	B.S.88: 1939	B.S.88: 1947		B.S.88: 1952	
		440 AC 4	440 AC 4	440 AC 5	440 AC 4	440 AC 5
30	TIA30	617	1016	2074	3334	3246
60	TIS60	616	903	2022	3338	3254
100	TC100	615	932	2021	3335	3263
200	TF200	251	933	2033	3278	3237
300	TKF300	252	934	2032	3255	3238
400	TM400	629	935	2031	3249	3240
500	TT500	354	936	2025	3250	3239
800	TLT800	353	2098	2026	3256	3251
1200	TX1200	•	•	•	3257	3258

**1200 amp rating added to range in 1952*

'ENGLISH ELECTRIC'
h.r.c. fuse links

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Fusegear Division, East Lancashire Road, Liverpool 10

FG.7CA6

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'CENTRE-FIX'

the pick of the packs

Crompton 'Centre-fix', an all-in-one lighting pack of fitting and tube, has these outstanding advantages:—

★ *80 w. tube, colour to your choice.*
'WARM WHITE' 'DE LUXE WARM WHITE'
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★ *Easy-fix spring-loaded lampholders*

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★ *Outstanding design, superb performance, superior style*

★ *'Permawhite' perfect enamel finish*

All-in-one Pack
80 w. fitting and tube complete

CHOICE OF ***FIVE*** *TUBE COLOURS*

105/-

including Purchase Tax

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RIGHT : Cross-section of transoceanic cable produced by Submarine Cables Limited, Erith.
BELOW : Paying out cable from H.M. Telegraph Ship "Manarch".
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STEEL ARMOUR WIRE
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COPPER RETURN TAPES
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For long service on the sea bed

Submarine telephone cable must give long and unfailing service under severe conditions. To ensure the utmost reliability, manufacture is rigidly controlled. For insulation, the cable depends on polyethylene, which combines chemical stability, light weight, inherent flexibility and ease of fabrication. It has excellent electrical properties and an extremely low rate of water absorption. The polyethylene is extruded directly over the centre copper conductor to extremely fine limits — plus or minus 3 thou. in.— to meet the exacting electrical requirements of the designers.

BAKELITE Polyethylene is unequalled for extrusion to such exacting limits and was used for 2,000 miles of cable recently produced by Submarine Cables Limited (owned jointly by Siemens and Telcon).

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OLYMPIA JULY 10-20

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It's a **STURDY** *transformer . . .*

OVER 25 YEARS' MANUFACTURING EXPERIENCE

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As supplied to Govt. Depts, National Coal Board, C.E.A. and many other large industrial undertakings.
From 500 VA to 100 kVA with special emphasis on the range 5 kVA to 100 kVA.

Sturdy ELECTRIC CO. LTD.

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PLASTIC CABLE CLIPS

The Cable Clip is designed to 'push fit' on to the cable.
The carbon steel pin is already part of the unit and will drive into wood, plaster or mortar.

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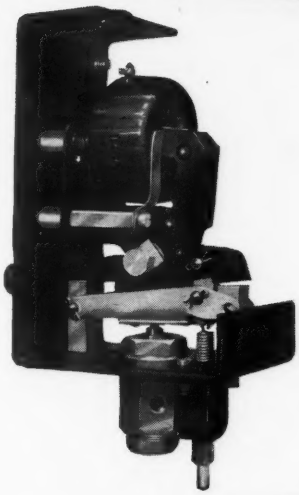
Publication 94000ZI gives full details of a useful range of Pressure Switches and Unloader Valves for pneumatic and hydraulic pressure-operated systems. The example illustrated is a diaphragm type for pilot circuits or direct switching small motors. Available with or without bleeder unloader valve and either double or triple pole.



Igranic Pilot Unloader Valves are designed for large compressors having pneumatically-operated unloaders. The type illustrated is for A.C. service and can be supplied for either loading or unloading the compressor when energised.

IGRANIC

PRESSURE SWITCHES & UNLOADER VALVES

The two items illustrated above are both available from stock

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A METAL INDUSTRIES GROUP COMPANY

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AIR INSULATED METAL-CLAD SWITCHGEAR

11 kV - 150 MVA

A.S.T.A. CERTIFIED

MADE TO THE SAME HIGH STANDARD AS ALL THE OTHER PRODUCTS OF

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"IGRANOHM" RESISTORS

MESSRS. FAWCETT PRESTON & CO. LTD. BROMBOROUGH, CHESHIRE, announce that from AUGUST 1ST, 1957, all sales, design and technical services relative to the above resistors, previously covered by the **IGRANIC ELECTRIC CO. LTD. BEDFORD,** will be transferred to Bromborough.

This development is designed to centralise production and technical services at Bromborough. It is therefore requested that, on and after August 1st, all correspondence relating to such matters be addressed to Messrs. Fawcett Preston & Co. Ltd., Bromborough, Cheshire, where a staff of specialist engineers will be available.

To avoid confusion the "Igranohm" resistor will in future be known as the "F.P. SERVICE" resistor while the "Igranohm Hi-Temp" resistor will be the "F.P. HI-TEMP" resistor.

These long-planned changes will have the effect of providing more efficient sales and technical facilities and will be to the general benefit of the many customers who have known and used these resistors in past years.

FAWCETT PRESTON AND COMPANY LTD
BROMBOROUGH CHESHIRE

MEMBERS OF METAL INDUSTRIES GROUP OF COMPANIES

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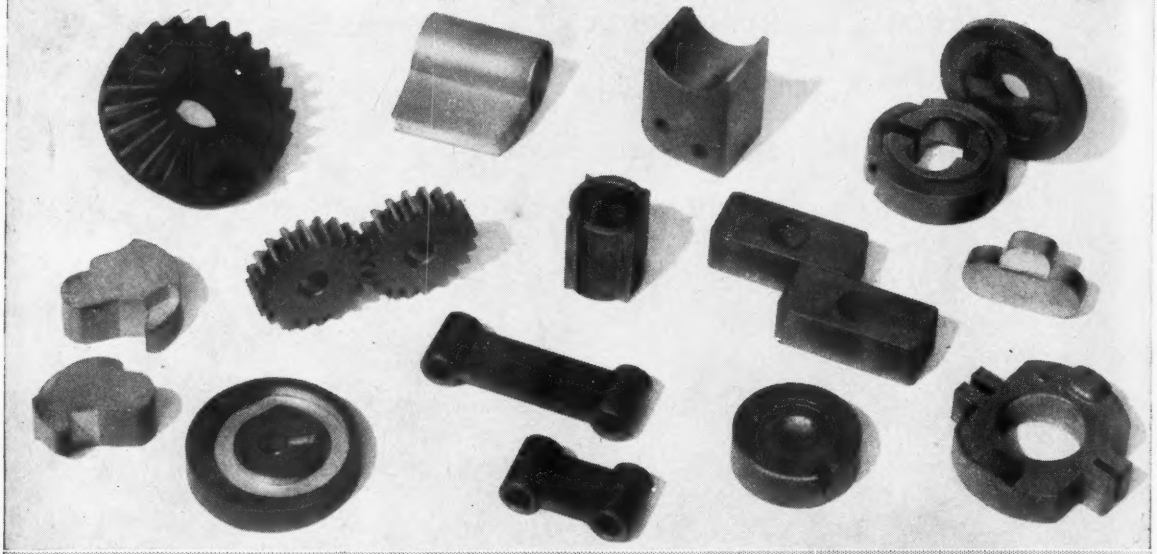
Machine Parts without machining!



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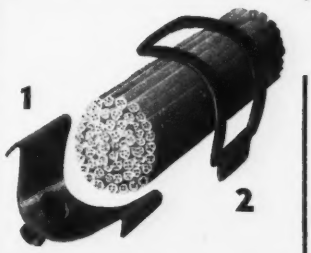
Insuloid Cradleclip

The Revolutionary new wiring system . . . reduces wiring time by half



1 . . . 2 . . . and it's fixed

Cradleclip brings a new high speed and simplicity to wiring. Makes wiring systems neater and more compact. Completely insulated and suitable for all climates. Wiring amendments made with the utmost ease. Electrical and mechanical security assured under all conditions.
Substantially reduces wiring costs.

Two simple movements and Cradleclip is truly fixed, quickly, efficiently and neatly ! The Insuloid Cradleclip system is rapidly becoming standardised by more and more Companies of international standing. Cradleclip, whilst being extremely simple in operation, sacrifices no point of technical efficiency and is suitable for service in all climatic conditions with a temperature range of —60°C to +100°C. Cradleclip is another Insuloid contribution to progress in electrical industry. We would be pleased to send you fully descriptive literature telling you all about the Cradleclip revolutionary wiring system on request.

Find out about these other Insuloid products

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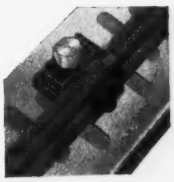
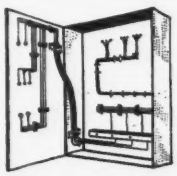
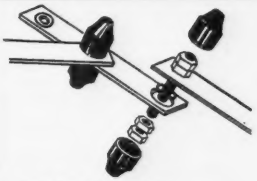
The quickest, most convenient, most versatile and economical cable fixing method known. Accommodate cables of any diameter, type and combination. Gives complete security, and reduces costs. Made in highest grade nylon for immense strength, high insulation and anti-corrosion and electrolytic action.



SAS Single Screw Adjustable Saddles
Another Insuloid quick fix efficient time saving system. Designed with slotted boss for engaging in slots in standard cable racking. Extremely economical and approved in service.



Cable Trunking FLEXIGUARD
Developed for cable-to-door wiring protection and speed of installation. Simple to fix and an obvious aid to wiring problems.



Bus Bar Insulation
Insuloid Busbar insulation. Shrunk-on hard plastic sleeving brings immediate savings in cost, time and production with increased efficiency and safety.

NX, X & Y Clip
A snap action, quick locking bush that will not come out after fixing. Simple finger action, instantaneous assembly for complete security in service. Non-metallic, high dielectric, fully tropical, approved all services.

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The well known Insuloid range of cable clips in nylon and P.V.C. For long service, anti-corrosive, non-chafing and very economical.

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Sharston Works, Leastone Rd., Wythenshawe. Tel. 2842

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Electric ALUMINIUM MELTING FURNACES

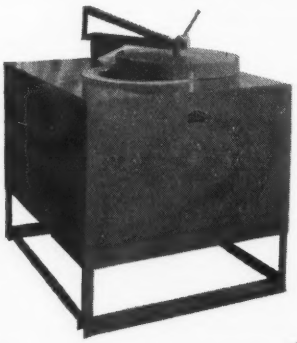
(bale-out or tilting) cut running costs

to say nothing of being cleaner and easier to work with

This is how —

- You have *much closer control* of your heat.
  You can go up to melting point and stop there. There is no need to waste heat beyond that point. This results in minimum losses in volatilisation.
- Electrically heated crucibles have a longer life due to the absence of flame impingement.
- The furnace is clean to work with, of very simple construction, and requires little or no maintenance.
- The elements are arranged for rapid heating, and can be easily replaced *without* dismantling the brickwork.

SIZES : 50 lb., 100 lb., 200 lb., 300 lb. and 1000 lb. capacity. Other sizes gladly built to order.



Hedin aluminium bale-out furnace.
Tilting type also available.

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Aluminium Brazing, continuous or batch : Sintering, to suit all temperatures : Continuous or batch annealing, with or without atmospheres : Forced Air Circulating : Steam atmosphere, arranged for rapid quenching : Special tungsten furnaces up to 2500 deg. C : Glass annealing lehrs, continuous or batch : Ceramic Kilns up to 1400 deg. C, tunnel or batch : Carbon resistor furnaces up to 3000 deg. C.

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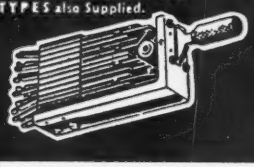
PROMPT DELIVERY

3000 TYPES

COILS up to 80,000Ω.
CONTACTS up to 8 c/o's
Tropicalizing and impregnating to order.
600 and HIGH-SPEED TYPES also Supplied.



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ALL POST OFFICE EQUIPMENT
Enquiries to Sales Dept.
126 KENSAL ROAD, LONDON, W.10
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Contractors to Home & Overseas Governments & H.M. Crown Agents

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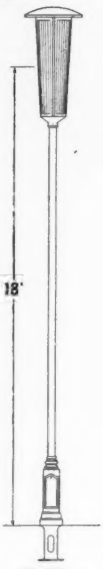
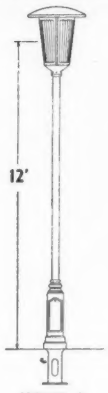
VERTICAL
FLUORESCENT FITTINGS *for* STREET LIGHTING



MODEL 1 with 18 ft. mounting, recommended for CLASS A Roads, will take any number of 4 ft. 40 W lamps up to six.

MODEL 2 with 12 ft. mounting, recommended for CLASS B Roads, will take two or four 2 ft. 40 W lamps.



- ALL FITTINGS COMPLETE WITH GEAR.
- Fittings can also be supplied with columns.
- The units are also suitable for two and three 45 W or 60 W sodium lamps with gear.
- Two "Perspex" panels are hinged for easy cleaning and lamp renewals.

MODEL 1 MODEL 2

For further details apply to:

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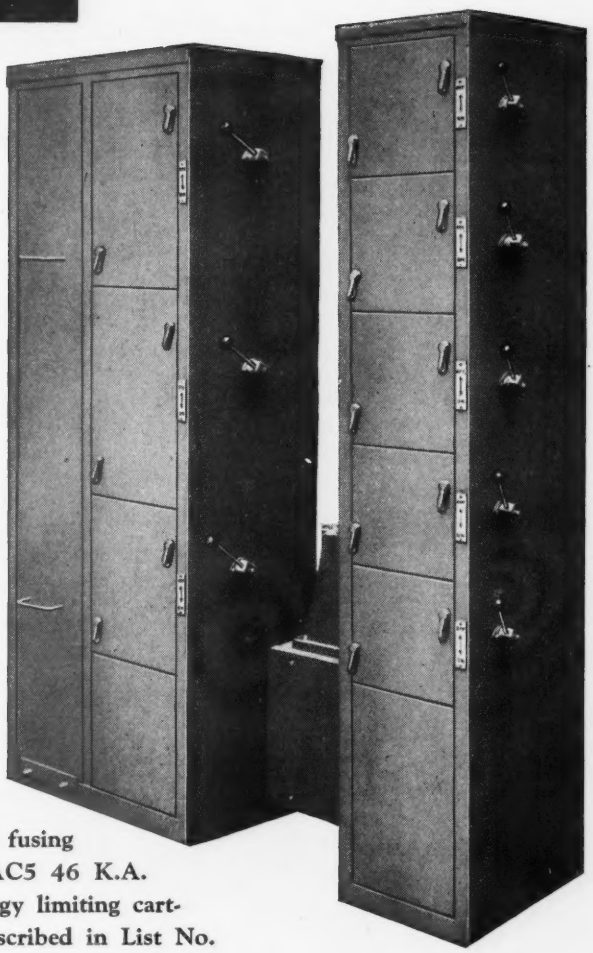


Aeroflex Class P 1.25 fusing factor, category 440 AC5 46 K.A. breaking capacity energy limiting cartridge fuse links, as described in List No. CF2, are now supplied in all standard Aeroflex-Fluvent gear, including *the new Fluvent Power Pillars* which are fully described in List No. PP1

Parmiter Hope & Sugden Ltd

FLUVENT ELECTRICAL WORKS · MANCHESTER 12

LONDON: 34 Victoria Street, S.W.1. *GLASGOW: 5 Somerset Place, C.3.* *BIRMINGHAM: Carrs Lane 4.*

dmPH110

G.E.C.

ELECTRIC UNIT HEATERS

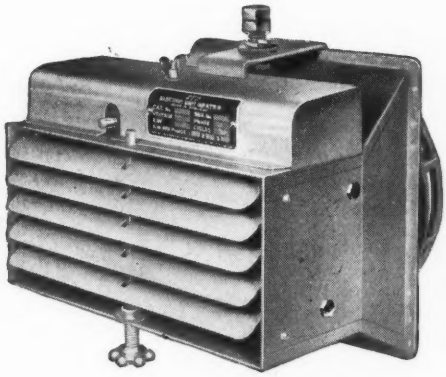
from stock

BUY NOW

and take advantage of current prices

The G.E.C. industrial unit heaters are available from stock in the complete range of sizes. Specially designed to ensure a comfortable working temperature all the year round, in factories, workshops and all branches of industry, the unit is fitted with a fan which embodies a special mounting to suppress noise. In winter, warm air is evenly distributed over a wide area, and in summer the fan of each unit can be operated independently of the heater to create a cool and refreshing atmosphere. Order now, and take advantage of current prices. Write for details of special quantity discounts.

5 kW £21.0.0
10 kW £30.0.0
15 kW £35.0.0
20 kW £35.10.0



THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue and should be addresssed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

BOROUGH OF CLEETHORPES

Trinity Road Housing Scheme

Sites 8B., 8C. & 8D.: Electrical Installations

TENDERS are invited from Electrical Contractors for the complete wiring installation for the following Dwellings :—

HOUSING SITE No. 8B.
Twenty-four Single-Bedroom Flats in Two Blocks of Eighteen and Six at Thornton Crescent.

HOUSING SITE No. 8C.
Twenty Single-Bedroom Aged Persons' Flats in One Block, Warden's Flat, Communal Room, etc., at Craithie Road.

HOUSING SITE No. 8D.
Thirty Type "K" Modified Houses in Pairs at Rufford Road.

The work will be carried out under a subcontract to the main building contracts.

Forms of tender, conditions of contract, specifications and all relevant information may be obtained from A. B. Cooper, A.M.I.C.E., Borough Engineer, Council House, Cleethorpes, where drawings may be inspected.

Applications for particulars must be accompanied by a deposit cheque of two guineas made payable to the Cleethorpes Corporation, which will be returned upon receipt of a bona fide tender.

Tenders in official sealed envelopes must reach the undersigned not later than 12 o'clock noon on Tuesday, 30th July, 1957.

The Council do not bind themselves to accept the lowest or any tender.

G. SUTCLIFFE,
Town Clerk.

Council House,
Cleethorpes.
11th July, 1957. 6745

SEDGLEY URBAN DISTRICT COUNCIL

District Road Lighting

TENDERS are invited from competent Electrical Contractors for the provision of Class B lighting on various District Roads as follows :—

Provision and erection of 21 Precast Concrete Columns with 80-watt Fluorescent Mercury equipment, together with all necessary gear, in Lake Street (10), Deepdale Lane (2), Cinder Road (8), all in Lower Gornal, and Bath Street (1), in Sedgley.

Conditions of contract, specification and form of tender may be obtained from W. M. Jones, Esq., B.Sc., A.M.I.C.E., Engineer and Surveyor, The Limes, Sedgley, on application accompanied by £2 2s. deposit, refundable on receipt of a bona fide tender, not subsequently withdrawn, or acceptable reasons for not tendering. Such application should be made not later than Tuesday, 30th July, 1957.

The date for return of the completed tender will be notified to applicants.

The Council does not bind itself to accept the lowest or any tender.

K. R. F. NEWTON,
Clerk and Solicitor
to the Council.

Council House,
Sedgley.
July, 1957. 6742

CLASSIFIED ADVERTISEMENTS ARE PREPAID

COUNTY BOROUGH OF BLACKPOOL

Illuminations and Street Lighting Department

TENDERS are invited for the supply and delivery of the following equipment :—

214 Group "B" Street Lighting Lanterns.
214 Prestressed Spun Concrete Columns and Concrete Brackets.
214 Synchronous Solar Dial Time Switches.

Specifications, forms of tender and general conditions may be obtained from the Illuminations and Public Street Lighting Officer, Illuminations and Street Lighting Department, Rigby Road East, Blackpool.

Tenders must be enclosed in plain sealed envelopes, bearing no name or mark to indicate the sender, but marked "Tender for Street Lighting Equipment," and must reach the undersigned not later than 10 a.m. on Wednesday, the 21st of August, 1957.

ERNEST C. LEE,
Town Clerk.

P.O. Box 11,
Town Hall, Blackpool. 6677

DURHAM COUNTY COUNCIL

TENDERS invited :—

Chopwell East County School : Electrical Installation.
Chopwell West County School : Electrical Installation.
High Spen County & Modern Schools : Electrical Installation.

Application for further details to County Architect, South Street, Durham, not later than 31st July, 1957.

J. K. HOPE,
Clerk of the County Council.

Shire Hall,
Durham. 6727

CITY OF MANCHESTER

TENDERS invited for Electrical Installation to Extensions at Briscoe Lane Primary School. Specification and drawings from City Architect, P.O. Box 488, Town Hall. Tenders returnable by 6th August. 6744

SITUATIONS VACANT

SOUTH EASTERN ELECTRICITY BOARD

LINESMAN (Overhead Power) (over 30,000 volts), Mid-Sussex Area (to be based in Brighton).

Wages 4s. 7½d. per hour for a 44-hour, 5-day week under N.J.I.C. Agreement. Applicants should have had experience in the construction and maintenance of steel tower lines.

Applications, naming two referees, to H. Pryce-Jones, J.P., M.Eng., Manager, Mid-Sussex Area, Mid-Sussex House, North Road, Brighton, by 29th July, 1957.

ASSISTANT DISTRICT ENGINEER, Thanet District.

Annual salary £685 × £15 to £730 under N.J.B. Class F, Grade 11. Superannuable. Applicants of at least Higher National Certificate standard should have had a sound training and experience in electricity distribution work covering the installation, operation and maintenance of E.H.V. and L.V. cables and O/H lines, indoor and outdoor substations and general distribution equipment.

Applications, naming two referees, to H. J. C. Carte, M.B.E., A.I.E.E., District Manager, SEEBOARD, Electricity Offices, St. Peter's, Broadstairs, Kent, by 31st July, 1957.

A. L. BURNELL,
Secretary.
6763

CENTRAL ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

STATION SHIFT CONTROL ENGINEER, ACTON LANE POWER STATION (Vacancy No. 57/628).

Candidates should possess good technical qualifications and have had training and experience in the control and operation of steam generating plant and main switchgear. Salary £935 plus £88 10s. shift per annum, Class J, Grade 10.

CHEMICAL ASSISTANT, ACTON LANE POWER STATION (Vacancy No. 57/629).

Duties will include testing coal, water and oil. Applicants should have passed G.C.E. in Chemistry, Physics and Mathematics, be studying for O.N.C. in Chemistry or for a higher qualification, and preferably have fulfilled National Service requirements. Salary T.S.T. Scale, £300 (age 18) to £560 (age 22).

ASSISTANT ENGINEER (Electrical Test), BATTERSEA POWER STATION (Vacancy No. 57/630).

Candidates will be on electrical maintenance staff and engaged on testing of protective gear associated with H.T. and L.T. power equipment, including primary and secondary injection of C.T. and relay currents, fault location on cables and control gear. Some knowledge of electrical equipment and commissioning of new plant will be considered an advantage. Salary £780 p.a., Class L, Grade 15.

ASSISTANT SHIFT CHARGE ENGINEER, BATTERSEA POWER STATION (Vacancy No. 57/631).

Experience in modern power station essential. Character and ability to deal with staff important. Salary £1,115 plus £106 10s. shift p.a., Class L, Grade 9.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, Central Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland Street, London, W.1, and be received within 10 days of this advertisement. 6717

CENTRAL ELECTRICITY AUTHORITY

North Eastern Division

Fourth Assistant Engineer (Section) Transmission Department, Malton

APPLICATIONS are invited for the appointment of FOURTH ASSISTANT ENGINEER (Section) in the Transmission Department with Headquarters at Malton.

Applicants should have had a good technical education and be experienced in the operation and maintenance of H.V. transmission systems.

The salary will be in accordance with the National Joint Board Agreement, Grade 5, Schedule B (£810-£1,010 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Divisional Establishments Officer, Central Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne, to whom they should be returned to arrive not later than 1st August, 1957. 6753

***Situations Vacant** (continued*

CENTRAL ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the following appointments :—

SENIOR DRAUGHTSMAN (Electrical), GENERATION (Construction) DEPT. (Vacancy No. 113/57/ER).

Candidates should have experience of the preparation of layouts and diagrams for the installation of E.H.T. and L.T. switchgear, transformers, E.H.T. and L.T. cables ; knowledge of protective gear systems would be an advantage.

SENIOR DRAUGHTSMAN (Civil), GENERATION (Construction) DEPT. (Vacancy No. 112/57/ER).

Candidates should have experience of the preparation of detail drawings and in the design of one or more of the following subjects :—

Reinforced concrete structures.
Pile and slab foundations for heavy components.
Cable subways, bridges and culverts.

SENIOR DRAUGHTSMAN (Mechanical), GENERATION (Construction) DEPT. (Vacancy No. 114/57/ER).

Candidates should have expeirence of one or more of the following :—

(i) Design and layout of power station equipment, including turbo-alternators, boiler plant, coal and ash plant and general station auxiliaries.
(ii) H.P. and L.P. steam and feed pipework. Condensing plant and feed heating systems.
(iii) Conveyor plant, coal handling systems and material handling of station auxiliary equipment.

Salary for vacancies 112/57, 113/57 and 114/57 will be within Grade 4 (£895-£995 per annum) or Grade 5 (£760-£860 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 31st July, 1957.

THIRD ASSISTANT ENGINEER (Electrical), GENERATION (Construction) DEPT., NORTH WILFORD POWER STATION (Site Office) (Vacancy No. 111/57/ER).

Applicants should have had a fundamental training in electrical engineering, including workshops, and should preferably have had experience in the manufacture, erection and maintenance and operation of electrical plant as installed in modern power stations. Preference will be given to candidates who possess a Degree or are Graduate Members of the Institution of Electrical Engineers.

Salary will be within Class AX/EX, Grade 4 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 31st July, 1957.

GENERAL ASSISTANT ENGINEERS, WILLINGTON, STAYTHORPE, SPONDON and DERBY POWER STATIONS (Vacancy No. 119/57/ER).

Applications are invited for the positions of General Assistant Engineer at the above stations where suitable young men will be given opportunities to obtain experience in all sections of a power station.

Preference will be given to candidates who hold the Higher National Certificate or who are at present pursuing a course of study with the object of obtaining this or a similar qualification.

The salary will be in accordance with the National Joint Board Agreement within the range £540-£730 per annum, according to knowledge and experience.

Closing date for receipt of applications, 31st July, 1957.

SHIFT CHARGE ENGINEER, BURTON-ON-TRENT POWER STATION (Vacancy No. 91/57/ER).

Sound technical training and practical experience in the control and operation of steam generating plant and main switchgear are required. Appropriate qualifications an advantage.

Salary in accordance with Class E, Grade 7 (£755-£820 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th August, 1957.

ASSISTANT, INTERNAL AUDIT, DIVISIONAL ACCOUNTANT'S DEPT., DIVISIONAL HEADQUARTERS (Vacancy No. 120/57/ER).

The position will be based at Nottingham, but will involve a substantial amount of travel within the Division's area.

Salary in accordance with Grade 3 (£660-£720 per annum) of the National Joint Council Agreement.

Applicants should have some experience of professional auditing or of internal audit work in a large organisation. Progress towards obtaining a recognised accountancy qualification would be an advantage.

Closing date for receipt of applications, 2nd August, 1957.

THIRD ASSISTANT ENGINEER (Mechanical), GENERATION (Construction) DEPT. (Vacancy No. 121/57/ER).

Applicants should have had a fundamental training in mechanical engineering, including workshops, and should preferably have had experience in the manufacture, erection, maintenance and operation of mechanical plant as installed in modern power stations. Preference will be given to candidates who possess a degree or are Graduate Members of the Institution of Mechanical Engineers.

Salary will be within Class AX/EX, Grade 4 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th August, 1957.

ASSISTANT MAINTENANCE ENGINEER (Electrical), STAYTHORPE POWER STATION (Vacancy No. 122/57/ER).

Applicants should have had a sound practical and technical training and previous experience of power station electrical maintenance is desirable.

Preference will be given to engineers in possession of, or qualifications leading to, Corporate Membership of the Institution of Electrical Engineers.

Salary will be within Class K, Grade 8 (£1,065-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th August, 1957.

FOURTH ASSISTANT ENGINEER, DRAKELOW TRANSMISSION SECTION OFFICE (Vacancy No. 123/57/ER).

The section contains extensive 275-kV and 132-kV equipment, and the candidates must have had wide experience in the maintenance and operation of 132-kV lines and substations in a transmission section.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 6 (£710-£935 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th August, 1957.

FOURTH ASSISTANT ENGINEER, COVENTRY TRANSMISSION SECTION OFFICE (Vacancy No. 124/57/ER).

Applicants should have experience of the maintenance and operation of high-voltage overhead lines, transformer and switchgear up to 132 kV.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 5 (£810-£1,035 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th August, 1957.

THIRD ASSISTANT ENGINEER (Electrical), GENERATION (Construction) DEPT., LINCOLN POWER STATION SITE (Vacancy No. 116/57/ER).

Applicants should have had a fundamental training in electrical engineering, including workshops, and should preferably have had experience in the manufacture, erection and maintenance and operation of electrical plant as installed in modern power stations. Preference will be given to candidates who possess a Degree or are Graduate Members of the Institution of Electrical Engineers.

Salary will be within Class AX/EX, Grade 4 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 31st July, 1957.

ASSISTANT SHIFT CHARGE ENGINEER, COVENTRY POWER STATION (Vacancy No. 125/57/ER).

Applicants are required to take charge of shift operation of boiler house plant and must possess a sound technical training, a good general engineering experience, and knowledge of the control and operation of water tube boilers, ancillary plant, and the efficient combustion of fuels on chain grate stokers.

Salary will be in accordance with Class G, Grade 9 (£835-£880 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th August, 1957.

These appointments will be pensionable within the provisions of the Central Electricity Authority and Area Boards (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Authority, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.

10th July, 1957. 6720

ENGINEERING IN THE CHEMICAL INDUSTRY ?

WHY is the Chemical Industry of interest to the Engineer ? Firstly, because it uses a wider selection of engineering plant and equipment than any other branch of industry ; secondly, because the problems which it has to tackle are such that their solution depends as much on the Engineer as on the Chemist. The industry is expanding rapidly, and at

IMPERIAL CHEMICAL INDUSTRIES LIMITED, WILTON WORKS,

over 4,700 men are working on the design and construction of the largest single project in Britain's chemical history.

Wilton Works is a manufacturing centre, with its own power station, where any Division of I.C.I. can build and operate production units. Twenty-one plants are in operation to-day, and included in these are "Perspex," "Terylene" and Titanium.

The number of

MECHANICAL, ELECTRICAL and INSTRUMENTATION ENGINEERS

required for design, construction, operation and work study is steadily increasing as the works continue to grow.

Salaries depend on ability and experience and are reviewed annually after appointment. Promotion is by merit alone and individuals are considered at regular intervals. Help will be given with housing and removing, and a lodging allowance will be paid for a period to married men selected for these appointments whilst maintaining two homes.

The design offices are pleasantly situated in the parklands of Wilton Castle, which lies at the foot of the Cleveland Hills.

Suitable applicants, who should possess an honours degree, will be invited for interview at the company's expense.

Please write to the

Staff Manager,
IMPERIAL CHEMICAL INDUSTRIES LIMITED,
Wilton Works,
Middlesbrough, Yorkshire,
quoting reference 403/6.

6685

BRITISH KLOCKNER SWITCHGEAR LIMITED
Chertsey, Surrey

TECHNICAL SALES ENGINEERS required for London and Home Counties. Knowledge of motor control gear ; sales experience preferred but not essential. Apply giving full particulars to—Managing Director. 166

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

FOURTH ASSISTANT ENGINEER (Operation and Maintenance).

Applicants should have experience in the operation of H.V. systems. The successful candidate will be required to take part in a rota of shift duties covering the Sheffield City network. Possession of a recognised technical qualification will be an advantage.

Salary N.J.B. Class M, Grade 13 (plus 10% shift allowance), £973 10s./£16 10s./£1,023 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 2nd August, 1957.

No. 7 (Grimsby) Sub-Area

THIRD ASSISTANT ENGINEER (Construction).

Applicants should possess at least the Higher National Certificate in Electrical Engineering and should preferably be Graduate Members of the Institution of Electrical Engineers. They should have experience in the design, construction, operation and maintenance of H.V. and L.V. underground and overhead distribution systems, substation plant and ancillary equipment.

Salary N.J.B. Class J, Grade 10, £885/£15/£930 per annum.

GRIMSBY DISTRICT

THIRD ASSISTANT DISTRICT ENGINEER.

Applicants should be of Higher National Certificate standard in Electrical Engineering and should have some experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and ancillary equipment.

Salary N.J.B. Class F, Grade 9, £790/£15/£835 per annum.

SCUNTHORPE DISTRICT

THIRD ASSISTANT DISTRICT ENGINEERS.

Applicants should be of Higher National Certificate standard in Electrical Engineering and should have some experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and ancillary equipment.

Salary N.J.B. Class F, Grade 9, £790/£15/£835 per annum.

GAINSBOROUGH DISTRICT

THIRD ASSISTANT DISTRICT ENGINEERS.

Applicants should be of Higher National Certificate standard in Electrical Engineering and should have some experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and ancillary equipment.

Salary N.J.B. Class E, Grade 9, £740/£15/£785 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than 2nd August, 1957. 6765

THE NUCLEAR POWER PLANT CO. LTD.

MECHANICAL ENGINEERS

required for design co-ordinating work on Nuclear Power Station Projects.

Preference will be given to applicants who hold a Degree in Mechanical Engineering, are Corporate Members of the Institution of Mechanical Engineers, or have passed all exempting examinations.

They should have experience in the design and construction of turbo-alternators, boilers, high-pressure steam and water piping, circulating water systems and other ancillary work, and some knowledge of the preparation of specifications and estimates and a knowledge of thermodynamics and hydraulics will be an advantage.

The successful applicants will work at Booths Hall, Knutsford. Assistance with house purchase will be given in appropriate cases.

Written application giving details of age, qualifications and career should be sent to the Secretary, The Nuclear Power Plant Co. Ltd., Booths Hall, Knutsford, Cheshire, quoting reference ER/CRD/14. 6734

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Maintenance and Operation)

ALDERSHOT District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class G, Grade 12 (£685 × £15 to £730 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution, mains and substations, and with minor construction work. The possession of suitable technical qualifications will be an advantage. The appointment will involve standby duties.

The successful candidate will be required to contribute to the C.E.A. and Area Boards (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed not later than 29th July, 1957. 6759

VERITYS LIMITED

Plume Works

Aston, Birmingham

WE are offering engineers progressive and interesting positions in an expanding company.

Rapid advancement to leading positions is open to suitable men of outstanding ability anxious to accept responsibility.

The following appointments are to be filled :—

(1) SWITCHGEAR DESIGNERS.
Sound technical knowledge and experience of development work is desirable.

(2) DESIGN ENGINEERS
for A.C. or D.C. motors.

(3) DRAUGHTSMEN.
All classes.

Assistance in the obtaining of a house will be given if required, and moving expenses paid.

Superannuation scheme available. Holidays will be honoured.

Reply in first instance by letter giving full details of qualifications and experience to—

HEAD OF RESEARCH AND DEVELOPMENT

6732

NATIONAL COAL BOARD

ASSISTANT ENGINEER (Electrical) required by N.C.B.'s Power Generation Branch of Production Department at London H.Q. Experience in electrical aspects of the design and construction or operation of steam power plants and preferably some knowledge of transmission and distribution of electrical power are required.

Appointment (superannuable) according to qualifications and experience, within inclusive range £814 to £1,414.

Write stating age, education, qualifications and experience to Staff Dept., National Coal Board, Hobart House, London, S.W.1, marking envelope X/827B, before 31st July, 1957. 6761

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts :—

South Staffs. and North Worcs. Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER (Stourbridge).

Applicants should have had experience in all branches of distribution work, including construction, operation and maintenance of high-voltage and low-voltage underground cables, overhead lines and substations. Technical qualifications desirable. Salary £790/£835 per annum (N.J.B. Grade F.9).

Apply, by letter, within fourteen days, stating age, qualifications, experience, present position and salary, to Mr. T. G. Keeler, Sub-Area Manager (Ref. CW), Midlands Electricity Board, P.O. Box No. 9, Toll End Road, Tipton.

Shropshire and Herefordshire Sub-Area

SENIOR SALES REPRESENTATIVES (Agricultural) (Hereford, Leominster, Ludlow, Shrewsbury and Wellington).

Applicants should have had extensive experience of rural development and sales, and be fully conversant with all domestic uses. Must have a sound knowledge of and be able to advise upon the uses of electricity in farming and horticulture. Be able to discuss intelligently relevant farming matters and practice and be prepared to give talks to the local agricultural and horticultural associations. The possession of a driving licence is essential and the ability to estimate for installation work and the possession of technical qualifications would be an advantage. Salary £660/£720 per annum (N.J.C. Grade 3).

Apply, by letter, within fourteen days, stating age, experience, present position and salary, and which District is preferred, to Mr. W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury.

A. STEPHENS,
Secretary. 6746

ASSISTANT DESIGN ENGINEERS (Electrical)

VACANCIES exist with the Engineering Branch of the Industrial Group of the UNITED KINGDOM ATOMIC ENERGY AUTHORITY at its HEADQUARTERS at RISLEY, WARRINGTON, LANCASHIRE.

DUTIES : To work as a junior engineer on the specification and design of electrical equipment for large factories, including H.T. and L.T. switchgear, substations and installations, or to supervise a team of draughtsmen engaged on layout work for substations and chemical process buildings, main cabling and all types of lighting and power installations.

QUALIFICATIONS AND EXPERIENCE: Candidates should have served a recognised apprenticeship and possess a Higher National Certificate, or equivalent, in Electrical Engineering and have had good drawing office and industrial experience in the duties involved.

SALARY will be assessed within the scale £795 p.a. to £1,210 p.a.

A contributory pension scheme is in operation.

Authority houses for renting by successful married candidates may be available in due course or, alternatively, substantial assistance may be given towards legal expenses incurred in private purchase.

Send a postcard for an application form, quoting reference 1970, to the Recruitment Officer, United Kingdom Atomic Energy Authority, Industrial Group Headquarters, Risley, Warrington, Lancashire.

Closing date, 5th August, 1957. 6680

CORPORATION OF THE CITY OF ABERDEEN

Lighting Department

APPLICATIONS are invited for the post of TECHNICAL ASSISTANT in the above Department at a salary within Grade C.S.6 (£565-£610). Particulars as to the appointment may be had from the Superintendent of Lighting, 262, King Street, Aberdeen, with whom applications should be lodged on or before 17th August, 1957.

J. C. RENNIE,
Town Clerk.

Town House,
Aberdeen.
3rd July, 1957. 9038

Situations Vacant (continued)

NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments :—

Area Board Headquarters, Chief Engineer's Dept., System Control Sub-Section

ASSISTANT DISTRIBUTION CONTROL ENGINEER (shift duties) at the Board's Sub-Control Centre at Aykleyheads, Durham City. The successful applicant will be given suitable training and will be required to assist in the centralised control and operation of high-voltage interconnected distribution networks operating at voltages up to 66 kV.

Applicants should preferably possess H.N.C. in Electrical Engineering or equivalent qualification, and be conversant with operation and maintenance of high-voltage distribution equipment. Knowledge of district work or protective gear operation an advantage.

Starting salary will be according to qualifications and experience and within the range of Schedule B, Grade 6, £781/£1,001 per annum, inclusive of 10% shift allowance. N.J.B. conditions of service.

Tees Sub-Area

THIRD ASSISTANT COMMERCIAL ENGINEER with location at Sub-Area Headquarters.

Salary Schedule A, Class K, Grade 10, £935/£995 per annum. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by the Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 6760

CENTRAL ELECTRICITY AUTHORITY

Southern Division

S/13.932

APPLICATIONS are invited for the following positions:—

GENERAL ASSISTANT ENGINEERS.

Applicants should have served an apprenticeship or had practical training suitable to the industry. They should possess a sound general and technical education and preference will be given to those possessing a Higher National Certificate (or those nearing completion of H.N.C. courses). Opportunities are available for general assistant engineers to complete their studies and gain wide experience with good prospects of promotion.

The duties of those appointed will vary, but will include as a general rule, the operation and control, under supervision, of generating plant. A number of these vacancies are at the oil-firing stations at Marchwood, Near Southampton, and Poole.

Vacancies also exist for those who wish to specialise in maintenance of electrical and mechanical generating plant, transmission lines, substations and cables, or generating station construction work.

Salary N.J.B. within scales £540-£730.

Special application forms for the above vacancies obtainable from P. D. A. Oliver, Divisional Secretary, 111, High Street, Portsmouth, should be returned by 31st July, 1957. 6749

CENTRAL ELECTRICITY AUTHORITY

Headquarters

ASSISTANT ENGINEER required in the System Planning Branch of the Chief Engineer's Department, London, S.E.1. Candidates should preferably possess technical qualifications at least equivalent to Grad. M.I.E.E. Practical experience in the transmission and/or generation sides of the electricity supply industry is essential. The duties will include assistance with the preparation of generating plant, extensions programmes and will be concerned with transmission reinforcements and general matters in connection with the planning and operation of specific areas of the system.

Salary £1,210-£1,570 p.a.

Applications stating age, qualifications, experience, present position and salary, to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 2nd August. Quote ref. E.R./316. 6755

DRAUGHTSMEN

DRAUGHTSMEN required for large electrical manufacturing company in South Africa. Experience of design, layout and detailing of electrical switchgear is desirable, but general experience on mechanisms and details is acceptable.

Some initial training may be necessary in this country before proceeding abroad.

All positions offer scope for advancement.

Apply stating age, qualifications, experience to—Box 6615.

IMPERIAL CHEMICAL INDUSTRIES LIMITED,

WILTON WORKS.

ENGINEERING DESIGNERS

who possess Higher National Certificate or its equivalent, and who have experience in the following branches of engineering :

MECHANICAL, CIVIL,
ELECTRICAL, STRUCTURAL,
ARCHITECTURAL,
HEATING AND VENTILATING,

are required to fill immediate vacancies in the Design Office. Over 4,700 men are at present employed on the design and construction of the works, which has its own power station.

Commencing salaries up to £900 per annum.

Profit sharing scheme and pension fund.

Housing : After joining the staff married men will receive a reasonable refund of removal (including travel) expenses and, to assist them in house purchase, facilities are available in approved cases for substantial loans. In addition legal charges will be advanced. A lodging allowance will be paid for a period to married men selected for these appointments whilst maintaining two homes.

The Design Offices are situated in the parklands of Wilton Castle, which lies at the foot of the Cleveland Hills.

Please write to me : Staff Manager, Imperial Chemical Industries Limited, Wilton Works, Middlesbrough, Yorkshire, quoting reference 404/6.

6686

ENGLISH ELECTRIC

STAFFORD

offers a worthwhile industrial career in a pleasant county town.

Professional Engineering Appointments

SWITCHGEAR APPLICATIONS ENGINEER.

SWITCHGEAR DEVELOPMENT ENGINEER.

SWITCHGEAR DESIGNER.

INSTRUMENT DEVELOPMENT ENGINEER.

CONTROL AND SERVO DESIGN ENGINEERS.

Applications are invited from engineers with experience in any of these fields either in the operating or manufacturing industry.

Any housing problems associated with taking up appointments can be discussed at interview and interim subsistence allowance and help with removal expenses will be given in appropriate cases.

Please write, in the first instance, giving full details, to Central Personnel Services, 336/7, Strand, London, W.C.2, quoting Ref. ER1296B.

6684

CITY AND COUNTY OF KINGSTON UPON HULL

Water Department

Station Superintendent

APPLICATIONS are invited for the post of STATION SUPERINTENDENT at a large pumping station.

Applicants should have experience in the running and maintenance of diesel alternator generating sets, associated switchgear, electric motors and centrifugal pumps. Preference will be given to candidates with first-class M.O.T. diesel qualification.

The salary is at the maximum increment, Miscellaneous Grade VI of the National Joint Council's Scales, viz., £686 15s. per annum.

—The person appointed will be required to take complete charge and reside at the station.

The appointment will be subject to the Local Government Superannuation Act, 1937, and to the passing of a medical examination.

Applications, stating age, details of experience, together with copies of two recent testimonials, should be forwarded to the undersigned not later than 10 a.m. on 3rd August, 1957.

Canvassing a member of the City Council or chief official will be a disqualification.

T. H. JONES, M.I.C.E.,
Water Engineer and Manager.

Water Dept.,
Alfred Gelder Street,
Kingston upon Hull. 6702

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

NORTHMET SUB-AREA,
ST. ALBANS DISTRICT
THIRD ASSISTANT ENGINEER
(Ref. 705) (87/57.N).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary N.J.B. Class F, Grade 9 (£790-£835).

Apply by letter to F. J. Drake, Assoc.I.E.E., District Manager, Eastern Electricity Board, 107, St. Peter's Street, St. Albans, Herts, by 29th July, 1957.

CHILTERNS SUB-AREA,
BEDFORD DISTRICT
FOURTH ASSISTANT ENGINEER
(88/57.R).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, including substations.

Salary N.J.B. Class F, Grade 11 (£685-£730).

Apply by letter within 14 days to R. F. Markham, A.M.I.E.E., A.M.I.I.A., District Manager, Eastern Electricity Board, Prebend Street, Bedford. 6747

CENTRAL ELECTRICITY AUTHORITY

RESEARCH LABORATORIES, LEATHERHEAD, SURREY require ENGINEERS in the Generation Section. Investigations cover a wide range of problems associated with conventional and nuclear power stations, including heat transfer in nuclear fuel elements and heat exchangers, electrostatic precipitators and cooling towers. Ability to apply fundamental knowledge to a wide range of problems important.

Candidates for 2nd and 3rd assistant vacancies should, preferably, have an honours degree with previous experience. For other posts a pass degee or H.N.C. is acceptable.

SECOND ASSISTANT ENGINEER, £1,160-£1,510 p.a.
THIRD ASSISTANT ENGINEER, £1,055-£1,265 p.a.
FOURTH ASSISTANT ENGINEER, £820-£995 p.a.
GENERAL ASSISTANT ENGINEER, £550-£725 p.a.

according to qualifications and experience.

Applications stating age, qualifications, experience, present position and salary, to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 6th August. Quote ref. E.R./315. 6754

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in the Chief Engineer's Department at Board Headquarters, Electricity House, Love Lane, Liverpool 3. Appointments subject to medical examination. Pension scheme.

SENIOR DRAUGHTSMAN (Electrical). The salary payable initially will be within the range £760/£860 per annum (N.J.B. Schedule D, Grade 5) with prospects of progress to Grade 4 (£895/£995 per annum).

Applicants should have had experience in the general design and layout of indoor and outdoor substations up to 33 kV, cable layouts and diagrams of connections, and have technical qualifications to a standard not less than for a National Certificate in Electrical Engineering.

ENGINEERING DRAUGHTSMAN The salary payable initially will be within the range £595/£715 per annum (N.J.B. Schedule D, Grade 6), with prospects of progress to Grade 5 (£760/£860 per annum).

Applicants should have experience in the general design and layout of indoor and outdoor substations up to 33 kV, cable layouts and diagrams of connections, and should preferably have reached the Ordinary National Certificate standard.

Application forms are obtainable from the Establishments Officer at the above address. Closing date, 1st August, 1957. 6731

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION

THE E.D.A. TESTING HOUSE is a national institution responsible for testing for safety and performance all types of domestic appliances, agricultural and light industrial equipment on behalf of Electricity Boards and the British Standards Institution. This interesting work is carried on in modern laboratories situated in Leatherhead, Surrey. Canteen facilities are available and the Association is operating a pension scheme. Applications are invited for vacancies in the following grades :—

TEST ENGINEERS. Applicants should have previous experience in electrical testing laboratory ; a knowledge of the design of domestic electrical appliances advantageous. Higher National Certificate in Electrical Engineering or Physics, or similar qualifications. Salary within the range of £810 to £935 per annum.

JUNIOR TEST ENGINEER. Applicants should have an interest in electrical testing and have attained as a minimum qualification National Certificate in Electrical Engineering or Physics. Salary within the range £550 to £625 per annum.

Apply in writing to the Director, British Electrical Development Association, 2, Savoy Hill, London, W.C.2. 6683

UGANDA ELECTRICITY BOARD

APPLICATIONS are invited for the permanent staff post of OFFICE SUPERVISOR for the Board's Head Office organisation in Kampala.

The person appointed will be responsible for the supervision of registry, filing and messenger systems, library, purchase and maintenance of office equipment, etc.

Applicants must have had several years' experience of the type of work referred to in a large modern office organisation and be familiar with up-to-date office equipment. Preference will be given to candidates with O. and M. experience and a secretarial qualification. Upper age limit 40.

Salary scale £1,045 × £30 to £1,315 ; commencing point according to age, qualifications and experience.

Uganda has a pleasant climate and income tax is moderate. Free passages, partly furnished accommodation and medical treatment. Six months' vacation leave on full salary after three years' service.

Application forms and further information may be obtained from the London Representative, Uganda Electricity Board, 27, Regent St., London, S.W.1, to whom completed forms should be returned not later than 30th August, 1957.

E. H. WILSON,
Secretary. 6728

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Dundee Area

APPLICATIONS are invited for the post of ASSISTANT ELECTRICAL MAINTENANCE ENGINEER at the Carolina Port Power Station.

Applicants should have a sound practical and technical training with experience in the maintenance of power station electrical plant and associated oil-circuit-breaker and transformers up to 132 kV.

The post is superannuable and the salary in accordance with N.J.B. Scale, Class F, Grade 8, £835 × £15 per year to £880.

Applications should be made on the Board's standard form, which, if not readily obtainable by applicant, should be requested from the Area Manager, North of Scotland Hydro-Electric Board, Dundee Area, 7, Dudhope Crescent Road, Dundee, and forms should be returned by Wednesday, 24th July, 1957.

R. B. ANDERSON, M.I.E.E.,
Area Manager.

7, Dudhope Crescent Road,
Dundee.
July, 1957. 6713

AUTOMATIC TEMPERATURE CONTROL

DESIGN & PROJECT ENGINEERS wanted for Technical Department of leading manufacturer of automatic temperature controls used for central heating, air conditioning, etc.

Design Engineers must have had experience in original design of small electro-mechanical devices either directly or indirectly associated with temperature control.

Project Engineers must have had experience in conversion of prototypes into production designs using latest production techniques.

Good salaries and pension schemes. Apply in writing stating training, experience and salary required to the Technical Superintendent, The Rheostatic Company Limited, Farnham Road, Slough, Bucks. 6704

FISHER & LUDLOW LTD.

require the services of several

ENGINEERS

who are thoroughly conversant with the steel flooring requirements of the power generation industry.

Applications are invited from men of mature age and experience who have good connections with consulting engineers, architects and constructional engineers.

Interviews arranged in London or Birmingham. Write in confidence giving full particulars of career to

Managing Director,
Steel Flooring Division,
FISHER & LUDLOW LTD.
Bordesley Works, Birmingham, 12

6736

ELECTRICAL DESIGN ENGINEER

required to take charge of section in Engineering Department responsible for design of Underground Mining Type Switchgear. Applicants should be technically qualified to at least H.N.C. standard and preferably have practical and/or design experience of flameproof equipment.

The position is one of responsibility and wide interest offering scope for advancement.

Applications should be addressed to the Technical Director, B.J-D. Ltd., Stennard Works, Wakefield. 6495

MINISTRY OF TRANSPORT AND CIVIL AVIATION

ELECTRICAL ENGINEERS (Assistant Signals Officers) required for work on civil aviation telecommunications networks and electronic navigational aids. Men or women. Minimum age 23. Qualifications: First or second class honours degree in physics or engineering or Corporate Membership of Institution of Electrical Engineers or Associate Fellowship of Royal Aeronautical Society (candidates who have passed Parts I, II and III of Associate Membership or Parts I and II of Associate Fellowship examination considered). Exceptionally candidates of very high professional attainment without these qualifications will be considered.

Salary within range £635 (age 23) to £1,030 (age 34). Scale maximum £1,190. Slightly less for women but subject to improvement under equal pay scheme. 5-day week where practicable. Appointments temporary (not pensionable) but established (pensionable) appointments may be obtained by success in open competition.

Further details and forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D204/7A. 6762

SENIOR ELECTRICAL ENGINEER

THE PLESSEY COMPANY at SWINDON wishes to appoint an Assistant to the Manager of Engineering and Sales of its ELECTRICAL CONNECTOR DIVISION.

A well-qualified electrical engineer is required, preferably with experience of the design and development of light and medium electrical connectors.

The appointment is a senior one and good personality is essential.

The remuneration will be generous and there is ample scope for advancement for the right man.

Those interested in pursuing this opportunity should write to :—

W. Chandler,
Manager of Engineering and Sales,
Connector Division,
The Plessey Company Limited,
Swindon, Wilts,

who will deal with applications personally and in complete confidence. 6703

EASTERN ELECTRICITY BOARD

Assistant Chief Commercial Officer (89/57.R)

APPLICATIONS are invited for the appointment of ASSISTANT CHIEF COMMERCIAL OFFICER at the Board Headquarters at Wherstead, near Ipswich.

Applicants should possess experience over the whole field of the commercial operations of the electricity supply industry, and will be required to be responsible for the section of the department dealing with general development of the supply system, including special aspects of utilisation. In addition to assisting the Chief Commercial Officer upon all general supply questions, the officer holding this key post in the Commercial Department will also be expected to deputise for the Chief Commercial Officer in his absence.

The salary for the appointment will be in accordance with Scale 5 of the N.J.M. Scale, and the successful candidate will be required to contribute to a superannuation scheme, and may be required to undergo a medical examination.

Apply by letter within 14 days to the Chief Commercial Officer, Eastern Electricity Board, P.O. Box No. 40, Wherstead, Ipswich, Suffolk. 6748

BARROW IRONWORKS LIMITED

Barrow-in-Furness

ASSISTANT ELECTRICAL ENGINEER required with sound technical training and practical experience on maintenance, installation, generation and control equipments up to 6,600 v. A.C. On heavy plant as associated with blast furnaces.

The post is superannuable.

Reply, giving full details of education, training, etc., to Managing Director, Barrow Ironworks Limited, Barrow-in-Furness. 6766

***Situations Vacant** (continued)*

DRAUGHTSMEN

DEVELOPMENT, DESIGN AND LAYOUT OF POWER STATIONS

IF you have had practical training and/or experience in an engineering drawing office and a technical training to O.N.C. or H.N.C. standard, join a team of experienced draughtsmen in the Chief Generation Engineer's (Constructional) Divisional Drawing Office, in either the mechanical, electrical or civil and structural engineering sections, at offices in Westminster.

Ample opportunities to gain knowledge of and for advancement in this important national work, including visits to site during construction.

Superannuation scheme and good working conditions with canteen facilities.

Vacancies exist at the following salary ranges:
MECHANICAL, from £635 to £1,045 p.a.
ELECTRICAL, from £635 to £910 p.a.
CIVIL and STRUCTURAL, from £800 to £1,045 p.a.

Apply by letter to Divisional Secretary, Central Electricity Authority, London Division, Generation House, Great Portland Street, London, W.1, or telephone MUSeum 6844, extension 240, for application forms. 6716

ARTHUR GUINNESS SON & CO. (DUBLIN) LTD.

St. James's Gate Brewery, Dublin

have a vacancy for an

ELECTRICAL DRAUGHTSMAN.

An excellent opportunity for an enterprising man between 23 and 28 years of age, possessing Higher National Certificate or Part 2 of I.E.E. Examination or equivalent, with experience in lighting, power and electronic layouts in process industry.

The post is a progressive one with a commencing salary in the range £596 to £800 commensurate with qualifications and experience. Promotion to higher grades possible.

Non-contributory pension scheme.

Assistance in moving home.

Please write to the Chief Engineer, giving chronological particulars of education, technical training, apprenticeship and posts held.

For those selected for interview, all travelling expenses will be paid. Successful candidate must pass a medical examination of high standard. 6665

CENTRAL ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following position at SOUTH DENES (Great Yarmouth) GENERATING STATION.

The station, which is at present under construction will have an ultimate capacity of 240 MW. Steam conditions will be 900 lb. sq. in. 900° F. with boilers oil fuel fired.

ASSISTANT ENGINEER
(Efficiency and Testing)

Salary N.J.B. Class H, Grade 7, £995 × £20 to £1,055 per annum.

Applicants should possess the Higher National Certificate in Mechanical and/or Electrical Engineering, and have had previous experience in the efficient operation and testing of modern boilers and turbo-alternators.

Applications, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Authority, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., by 27th July, 1957.

W. N. C. CLINCH,
Controller.
6662

INTERNAL SALES DEPARTMENT

VACANCIES exist for staff to handle composite contracts for all types of electrical rotating plant and associated equipment in the medium and large size classes.

Applicants with H.N.C. or O.N.C. preferred, but others with suitable experience would be considered.

Please write for application form, quoting reference "H.9," to

Personnel Manager,
METROPOLITAN-VICKERS ELECTRICAL CO. LTD.,
Trafford Park, Manchester, 17 6679

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Dundee Area

APPLICATIONS are invited for the post of ASSISTANT CHARGE ENGINEER at the Carolina Port Power Station.

Applicants should have a sound technical and practical training with, preferably, experience of high-voltage system switching and control and knowledge of power station plant both electrical and mechanical.

The post is superannuable and the salary in accordance with N.J.B. Scale, Class F, Grade 9, £790 × £15 per year to £835 (plus 10%).

Applications should be made on the Board's standard form which, if not readily obtainable by applicant, should be requested from the Area Manager, North of Scotland Hydro-Electric Board, Dundee Area, 7, Dudhope Crescent Rd., Dundee, and forms should be returned by Wednesday, 24th July, 1957.

R. B. ANDERSON, M.I.E.E.,
Area Manager.
7, Dudhope Crescent Road,
Dundee.
July, 1957. 6743

COUNTY BOROUGH OF BLACKPOOL

Illuminations and Street Lighting Department

APPLICATIONS are invited for the superannuable post of SENIOR TECHNICAL ASSISTANT within the Qualified Engineering Assistants' Grade (£707 5s. p.a. × £30 15s. to £861 p.a.).

Candidates should hold qualifications of Grad. I.E.E. standard and have experience of distribution networks and specification drafting.

Exceptionally, a candidate with suitable experience but lacking the above qualifications may be appointed on a lower commencing grade.

Forms of application, together with details of special conditions of service which apply, will be sent on application to the Illuminations and Public Street Lighting Officer, Illuminations and Street Lighting Department, Rigby Road East, Blackpool, and completed applications must be received by him not later than 10 a.m. on Friday, 2nd August, 1957.

ERNEST C. LEE,
Town Clerk. 6678

CENTRAL ELECTRICITY AUTHORITY

South Eastern Division

APPLICATIONS are invited for the position of FOURTH ASSISTANT ENGINEER in the Divisional Transmission Engineer's Department. This position is initially for the Brighton District by the successful applicant may be required to move to another area within the Division at a later date. Candidates should preferably have had experience in the maintenance of steel tower overhead lines and E.H.T. switchgear and transformers. Possession of Higher National Certificate an advantage.

N.J.B. conditions of service and salary Class AX/EX, Grade 6, £710-£835-£910 per annum.

Applications giving details of education, experience, present position, etc., should be sent to the Establishments Officer, Central Electricity House, Lower Ham Road, Kingston-on-Thames, Surrey, so as to arrive by 17th August, 1957, quoting reference (205). 6752

DESIGNER-DRAUGHTSMAN

required by

W. H. ALLEN SONS & CO. LTD.
BEDFORD,

for work in the development and design of A.C. and D.C. motor control gear.

This position offers interesting work and good prospects to the selected candidate.

Generous pension scheme. Assistance towards removal expenses.

Apply in writing, giving full details of experience, to the Personnel Manager. 6663

THE NUCLEAR POWER PLANT CO. LTD.

SENIOR MECHANICAL AND ELECTRICAL DRAUGHTSMEN

required, experience in any of the following will be an advantage:—

(1) Layout of turbo-alternator and ancillary plant.
(2) H.P. pipework layouts.
(3) Mechanical handling equipment.
(4) Circulating water systems.
(5) Electrical schematic diagrams.
(6) Layout of switchgear and transformers.

The successful applicants will work at Booths Hall, Knutsford, and in appropriate cases assistance will be given with house purchase.

Written application giving details of age, qualifications and career should be sent to the Secretary, The Nuclear Power Plant Co. Ltd., Booths Hall, Knutsford, Cheshire, quoting reference ER/CRD/15. 6735

NORTH WESTERN ELECTRICITY BOARD

ENGINEERING DRAUGHTSMAN, SUB-AREA ENGINEER'S DEPARTMENT, OLDHAM.

Applicants should have had a good general and technical education and be experienced in one or more of the following subjects:—

Electrical diagrams, layout of switchgear, transformers, etc., within substations, and drawing office routine.

Possession of a technical qualification such as the O.N.C. or H.N.C. in Electrical Engineering will be an advantage.

Salary within the range £595 × £20 to £715 p.a., Schedule D, Grade 6. N.J.B. conditions.

Applications, naming three referees, to Sub-Area Manager, No. 3 Sub-Area, North Western Electricity Board, Union Street, Oldham, by 27th July, 1957. 6714

CENTRAL ELECTRICITY AUTHORITY

Midlands Division

GENERAL ASSISTANT ENGINEERS are required at Stourport "A" and "B" Power Stations for generation operational duties. N.J.B. service conditions, superannuable appointment, salary within Schedule A, £740-£785 per annum. An additional 10% of basic salary is payable when engaged on shift duties.

The appointments are permanent with excellent opportunities for advancement. It is necessary that applicants should have received a sound technical training and should preferably have had some industrial engineering experience and have as a minimum qualification the Ordinary National Certificate.

Apply, quoting vacancy number 590MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 1st August, 1957. 6682

CENTRAL ELECTRICITY AUTHORITY

Midlands Division

SECOND ASSISTANT STATION CHEMIST is required for Nechells A and B Power Stations. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade 11, Class K, £885-£930 per annum.

Candidates should have had experience in analytical chemistry in power station laboratories or the industrial field and have a minimum qualification of Ordinary National Certificate in Chemistry or hold an equivalent qualification and should preferably be engaged in a course of study for a higher qualification.

Apply quoting vacancy number 600MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 31st July, 1957. 6756

SOUTH WALES ELECTRICITY BOARD

ASSISTANT ENGINEER (Substation) required at the Headquarters of the Western Sub-Area of the Board, Tenby.

Salary Class G, Grade 10 (£790/£835) of the N.J.B. Schedule.

Applications, stating age, present position and salary, qualifications, experience and three referees, should be addressed to the Secretary (Establishments Section), to arrive not later than 29th July, 1957.

R. G. WILLIAMS,
Secretary.
St. Mellons,
Cardiff. 6764

BRITISH INSULATED CALLENDER'S (SUBMARINE CABLES) LTD.

have the following vacancy :

DEVELOPMENT ENGINEER for Submarine Power Cables of all types and voltages. The work will include the development of cable types, new constructions, materials and manufacturing processes.

Applicants must have completed National Service and should preferably hold a degree in electrical or mechanical engineering, or have qualifications equivalent to an Associate Member of the Institution of Electrical or Mechanical Engineers, and be between the ages of 28/45.

Previous experience of cable manufacture would be an advantage.

Please reply stating full background and salary required to the Secretary, B.I.C. (Submarine Cables) Ltd., Trafford Park, Manchester, 17. 6733

NOTTINGHAMSHIRE COUNTY COUNCIL

County Architect's Department

Assistant Electrical Engineers (2)

APPLICATIONS are invited for the post of ASSISTANT ELECTRICAL ENGINEER at a salary of £707 5s. to £861 per annum according to experience and qualifications. Experience in the design and supervision of lighting and power installations in schools and other Local Authority buildings would be an advantage.

Application forms from Donald Gibson, County Architect, County Hall, Trent Bridge, Nottingham, to whom they should be returned not later than 2nd August, 1957.

A. R. DAVIS,
Clerk of the County Council.
6729

CENTRAL ELECTRICITY AUTHORITY

Midlands Division

SHIFT CHARGE ENGINEER is required at Nechells "A" Power Station, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade G7, £935 to £995 per annum, plus 10% when engaged on shift work.

Applicants should have received a sound practical and technical training and experience in the operation and maintenance of steam generating plant and main switchgear. Appropriate qualifications an advantage.

Apply, quoting the vacancy number 594MD, on form AE6, available from the Establishments Officer, Central Electricity Authority, 53, Wake Green Road, Moseley, Birmingham, 13, by 3rd August, 1957. 6719

CENTRAL ELECTRICITY AUTHORITY

Headquarters

ASSISTANT ENGINEER required in the Transmission Design Branch in London to deal with circuit breaker problems. Applicants should have good experience of the design and construction of modern E.H.V. circuit breakers of high rupturing capacity and should preferably have some direct experience of short circuit testing. Engineering and educational qualifications not below A.M.I.E.E. standard are essential.

Salary within £1,105-£1,315 p.a. according to qualifications and experience.

Applications stating age, qualifications, experience, present position and salary to D. Moffat, Director of Establishments, Winsley St., London, W.1, by 31st July. Quote ref. ER/311. 6681

CENTRAL ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 122/57. Ref. 149/8/JLH/EB.

APPLICATIONS invited for superannuable N.J.B. appointment of ASSISTANT SHIFT CHARGE ENGINEER, TIR JOHN POWER STATION, PORT TENNANT, SWANSEA.

Salary H.9, £885 × £15 to £930 per annum.

H.N.C. or equivalent qualifications and regular apprenticeship desirable. Experience in operation of modern generating plant essential.

Application forms from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 31st July, 1957. 6751

LONDON ELECTRICITY BOARD

Engineering Draughtsmen

APPLICATIONS are invited for the above posts in the Board's South Eastern District at Woolwich, S.E.18.

Applicants should have a good general and technical education, and also experience in layouts of substations and transformer chambers for voltages up to 11 kV, site plans and mains records.

The posts are graded under Schedule D of the National Joint Board Agreement as Grade 6, £635 to £755 per annum, inclusive of London allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed by 3rd August, 1957. Please quote ref. PER/2274/R. 6758

SQUARE D LIMITED
100, Aldersgate Street
London, E.C.1

ELECTRICAL ENGINEER, B.Sc., or equivalent. Age 30-40, with experience in design and application of electric motor control desired.

To serve as assistant and understudy to present temporary American Chief Engineer.

Write to General Manager giving details of education, experience and salary requirements.

Applications will be treated as confidential.

9041

AUSTRALIA—UNIVERSITY OF MELBOURNE

APPLICATIONS are invited for a position of SENIOR LECTURER IN ELECTRICAL ENGINEERING.

Applicants should have had experience in servo-mechanisms and closed loop control.

The salary range is £A1,850 to £A2,150 per annum. Initial salary will be determined according to qualifications and experience. Superannuation similar to F.S.S.U. in Great Britain will be provided.

Conditions of appointment may be obtained from the Secretary, Association of Universities of the British Commonwealth, 36, Gordon Square, London, W.C.1.

Applications close, in Australia and London, on 30th September, 1957. 6715

CENTRAL ELECTRICITY AUTHORITY

Midlands Division

MAINTENANCE ENGINEER (Mechanical) is required at Stoke Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade E6, £885 to £930 per annum.

A sound technical training and practical experience in power station mechanical maintenance is required, and the possession of appropriate technical qualifications will be an advantage. Qualified marine engineers would be considered suitable.

Apply, quoting vacancy number 593MD, on form AE6, available from the Establishments Officer, 53, Wake Green Rd., Moseley, Birmingham, 13, by 3rd August, 1957. 6718

CENTRAL ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 123/57. Ref. 149/4/JLH/EB.

APPLICATIONS invited for superannuable N.J.B. appointment of FIRST ASSISTANT STATION CHEMIST, NEWPORT POWER STATION.

Salary F.9, £790 × £15 to £835 per annum.

Degree in chemistry or equivalent. Experience in water treatment, coal and oil testing and corrosion problems desirable.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 31st July, 1957. 6750

MIDDLESEX COUNTY COUNCIL EDUCATION COMMITTEE

GENERAL MAINTENANCE ENGINEER required at Acton Technical College. Salary £543 5s. to £625 5s. (plus London weighting). 44-hr. wk. Sound knowledge of operation of central heating and domestic water services, gas and extract ventilation installations and of electric lighting and power installations required.

Prescribed conditions.

Apply stating qualifications, previous experience and names of two referees to Principal, Acton Technical College, High Street, Acton, London, W.3 (quote V.598 ER). Canvassing disqualifies. 6701

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

STORES SUPERINTENDENT required in the No. 2 Sub-Area Accounts Department at Eversley, Frodsham, near Warrington. Salary within range £890/£965 p.a. (N.J.C. Grade 6).

Applicants should have a sound knowledge and practical experience of the organisation and operational control of stores and stores records, and be experienced in the supervision of staff. Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway House, near Northwich, Cheshire. Closing date, 31st July, 1957. 6730

CENTRAL ELECTRICITY AUTHORITY

South Western Division

ASSISTANT ENGINEER (Instruments) required at Portishead "B" Power Station. Superannuation scheme. Salary N.J.B. Class J, Grade 10, £885-£930.

Candidates should have previous experience of modern power station plant, with a sound technical training and good practical knowledge of the construction, repair and testing of power station instruments and automatic controls.

Applications on form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Rd., Bristol, 8, should be completed and returned by 31st July, 1957. 6757

BRITISH KLOCKNER SWITCHGEAR LIMITED

Chertsey, Surrey

ESTIMATOR for TECHNICAL SALES. Correspondence and capable of preparing control schemes involving automatic motor control gear. Experience essential.

CIRCUIT DIAGRAM DRAUGHTSMAN. Preferably experienced in preparing automatic control gear schemes.

Applicants to have O.N.C. (Electrical). Excellent opportunities with fast growing concern. Pension scheme. Apply to Managing Director, stating experience and present salary. 165

A LARGE and progressive London company manufacturing electronic telephone and telecommunication equipment has vacancies for technical engineers and assistants with suitable qualifications and previous experience. Work will cover circuit design and laboratory testing of new switching development projects, using both standard and electronic methods, or the preparation of equipment layouts and exchange and contract specifications. B.Sc., H.N.C., or final C. and G. in telecom., all desirable, but main emphasis on experience. Salaries in the range of £450-£900 for assistants and £700-£1,100 for seniors according to age and qualifications. Excellent conditions and prospects. Assistance with removal and housing difficulties if necessary. We are looking for men of ability and invite you to write in confidence with full details to—Box 6767.

ARMATURE winders wanted for repair shop. Apply — Minta, Hartley Road, Luton. 9036

ASSISTANT engineer required by lighting equipment and transformer manufacturers in London. Ability to handle small staff. Good opportunities for advancement. Apply stating experience and salary required.—Box 9042.

CLASSIFIED ADVERTISEMENTS ARE PREPAID

***Situations Vacant** (continued)*

BRITISH INSULATED CALLENDER'S CONSTRUCTION Co. Ltd. have vacancies in their overhead line contracts department in London for draughtsmen. The work involves the preparation of arrangement and detail drawings for electrical transmission and distribution lines. The posts offer advancement to the status of designer-draughtsman. Attractive salaries will be offered to suitable applicants. Pension fund, staff canteen, 5-day week. Apply in writing, stating age, to Personnel Officer (Staff) above company at 30, Leicester Square, London, W.C.2. 6721

CANADIAN electrical company requires estimating and contract engineer for transformer and switchgear department. Location Montreal. Applications addressed to—Box 6768, will be forwarded to Canada.

CHIEF electrical engineer. Applicant must be fully trained and preferably graduate engineer able to deal with problems of high and low tension factory power distribution connected with works maintenance and the installation of heavy rolling mills and their ancillary equipment. Must also be conversant with fully automatic control gear, substation layouts with grid control rectification. Pension scheme. Age 28-40. Apply giving age, salary expected and full details of qualifications and experience to—The Chief Engineer, The Weldless Steel Tube Co. Ltd., Wednesfield, near Wolverhampton, Staffs. 6621

CIRCUIT draughtsmen required by firm manufacturing industrial control equipment. Commencing salaries up to £800 per annum for first-class men, but some less experienced draughtsmen required. Canteen facilities, pension scheme, holiday commitments recognised. Housing assistance later to approved cases. West Middlesex area. Write, giving age, experience and full details, to—Box 6434.

CONTRACTORS, old-established and progressive, invite applications for posts of: (a) Experienced estimating engineer; (b) Designer draughtsman able to design electrical installations of all descriptions; (c) Junior for (a) or (b). The posts offer good prospects and salary, also visits to sites. Write in confidence to Managing Director, Alliance Electrical Co. Ltd., 2, Henrietta Street, London, W.C.2. 190

DRAUGHTSMAN required for L.T. switchgear manufacturers in Westminster area. Splendid prospects for ambitious man. Write age, experience and salary required.—Box 6769.

DRAUGHTSMEN required, preferably with experience of medium voltage metalclad industrial switchgear. A.E.S.D. rates of pay and bonus scheme, non-contributory superannuation scheme also in operation. Assistance with housing will also be given if necessary to selected applicants. The company is within 6 miles of the South Devon coast. Write stating experience, age, etc., to Ottermill Switchgear Ltd., Ottery St. Mary, Devon. 6477

EDMUNDSONS CONSTRUCTION Company Limited invite applications from those suitably qualified with a view to taking responsibility for the company's electrical contracting activities in the North of England, operating from offices in Leeds. Applications, which will be treated with the strictest confidence, to be made in writing and addressed to the Chairman of the Company at 240/250, Ferndale Road, London, S.W.9. Employees of the company have been notified of this vacancy. 6705

ELECTRICAL contractors, City of London, have opening for senior supervising estimating engineer, commercial and industrial contracts up to £20,000. Reply in strict confidence giving full details of experience and salary required.—Box 6722.

ELECTRICAL contractors Midland area, well-established and growing company, require assistant manager and estimator. State experience and salary required.—Box 6587.

ELECTRICAL draughtsmen with experience of large transformer tank design and detailing up to 10,000 kVA required by consultants in London, S.W.1. Good mechanical draughtsmen who wish to specialise in this work will be given training in this expanding business with a stable future. Excellent salaries paid to experienced men with A.E.S.D. rate as minimum. Seniors and juniors are asked to apply to—Box 6738.

ELECTRICAL engineer required as branch manager (Manchester area) of established electrical contractors. Applicants should have sound knowledge of electrical contracting industry. Reply in strict confidence giving full details of experience and salary required to—Box 155.

ELECTRICAL engineer required for Goa, Portuguese India, in the first instance for a three-year tour. Duties will include supervision of installation of 3 × 850-kW diesel sets and small overhead/underground distribution network. Accommodation provided. Applications giving full particulars of experience and qualifications, quoting reference L.10, to—Box 6706.

ELECTRICAL engineers with design office in London require men with experience of high-voltage switchgear for the preparation of schematic and detail wiring diagrams; site experience and knowledge of protective gear would be an advantage. Salary according to experience, but not less than A.E.S.D. rate.—Box 6737.

ELECTRICAL sales engineer required for London and Home Counties. Experienced man preferred, but consideration given to representative with genuine urge to sell motors and control gear. Good salary, pension scheme. Write stating full particulars to—Ref. P.M., Veritys Ltd., Brettenham House, Lancaster Place, Strand, London, W.C.2. 6588

ESTIMATOR required by old-established electrical contractors handling medium-sized contracts. Excellent prospects for someone with sound electrical knowledge plus administrative ability. Apply Manager, Electrical Dept., Rely-a-Bell, 54, Wilson Street, London, E.C.2. 6687

EXPERIENCED plastics extruder operator required for the production of special cables. New department and plant. A man with initiative and one looking for advancement essential. Write, stating experience, in the first instance—Box Y.556, c/o Streets, 110, Old Broad Street, London, E.C.2. 140

FITTERS (electrical) required for vacancies at Pontardulais and Neath, South Wales. N.J.I.C. rate (4s. 7½d. per hour) and conditions. Applications giving age, present employment and previous experience should be sent to Mr. G. R. T. Edwards, West Central Sub-Area Manager, South Wales Electricity Board, Fforestfach, Swansea, by 29th July, 1957. 6739

GRANADA Group require a senior engineer. He will be responsible for installation and maintenance of all electrical equipment and heating and ventilating plant in theatres, restaurants, shops and other buildings. Preference given to chartered engineer with sound practical experience and able to prepare schemes for new installations. Superannuation scheme. Write details of age, experience and salary required to Managing Director, Granada Group Ltd., 36, Golden Square, London, W.1. 6688

INSIDE sales and contracts engineers required by the Electrical Rotating Machines Division of the Brush Electrical Engineering Company Ltd. at Loughborough, Leicestershire. Applicants should have received an engineering training and possess an O.N.C. in Electrical Engineering as a minimum qualification. Previous commercial experience will prove an advantage, as successful applicants will be required to handle correspondence with customers, with home and overseas representatives, and to prepare and submit tenders and/or to handle resultant orders. A good salary will be paid, commensurate with the importance of the job, and attractive working conditions include a generous non-contributory superannuation scheme. Applications, giving particulars of past experience and qualifications, should be addressed to the Chief Personnel Officer. 6635

INSTRUMENT testers required for test room with experience in wiring, calibration and testing of electrical measuring instruments. These are staff appointments. Apply in writing to—Everett, Edgcumbe & Co. Ltd., Colindale Works, Hendon, London, N.W.9. 6689

MICA and electrical insulation generally: Supervisors or operatives possessing special knowledge of skills in the working of mica or allied products in the electrical insulation field and who are keen to join a progressive company where they may be given the opportunity of running their own departments are invited to write to the Director, Box Z.T.411, Deacon's Advertising, 36, Leadenhall Street, London, E.C.3. 6723

MANAGER required by London electrical contractor for the Leeds area branch. Applicants must be conversant with all types of electrical contracts, P.A. installations, P.A.X. telephone installations. Please reply stating age, salary required, to—Giles (Electrical Engineers) Limited, 37-41, Bedford Row, London, W.C.1. 6564

MANAGER required by London electrical contractor for the Sheffield area branch. Applicants must be conversant with all types of electrical contracts, P.A. installations, P.A.X. telephone installations. Please reply stating age, salary required, to—Giles (Electrical Engineers) Ltd., 37-41, Bedford Row, London, W.C.1. 6565

MANAGER required for radio and electrical department in large overseas store. This vacancy will be of particular interest to men possessing real initiative who are interested in working in a rapidly developing country where their progress will depend solely on their own efforts and abilities. Applicants, who should not be over age 35, must have experience of management in the selling and servicing of well-known makes of radio and electrical equipment. The vacancy is in West Africa and the commencing salary will depend on qualifications and experience, but will not be less than £1,000 per annum. In addition there are family allowances, free furnished quarters, free passages and free medical attention in Africa. There is a contributory pension fund which provides certain guaranteed benefits, including widows' and children's pensions and provision for retirement where the qualifying age for a pension is not reached. Initial kit allowance of £75. Tours of about 21 months each followed by substantial leave on full pay. Apply giving particulars of experience to—Box 6601.

OPPORTUNITY for keen man (about 30) to take charge of sales office of old-established firm in lighting industry. Experience in lighting fittings sales activities desirable but not essential. Applicants must have good knowledge of the electrical trade and be accustomed to dealing with users, contractors, architects, etc. Good prospects for keen organiser. 5-day week; pension fund. Write fully, stating age, experience and salary range.—Box 6690.

OPPORTUNITY in a medium-sized heavy electrical manufacturing concern. An important vacancy in higher management on the works side. Applicants (30/45) should have a thorough engineering background and be fully conversant with modern manufacturing and production methods. Give qualifications, full details of experience, salary required and age. —Box 6592.

OUTSIDE sales engineers required to undertake the selling of small fusegear units and ancillary equipment. Applicants should preferably have received a sound electrical engineering background, but it is also desirable that they should have had experience of the wholesale electrical trade. This is an excellent opportunity for men with initiative. The successful candidates will operate from certain of our branch offices throughout the country, after an initial training period at our Loughborough works. A good salary will be paid commensurate with the importance of the job, and attractive working conditions include a generous non-contributory superannuation scheme. Applications, giving particulars of past experience and qualifications, should be addressed to the Chief Personnel Officer, Brush Electrical Engineering Co. Ltd., Loughborough, Leics. 6636

PHILIPS ELECTRICAL Limited wish to appoint a man with electrical/mechanical engineering qualifications, preferably of H.N.C. standard, as a technical/commercial assistant in the high frequency heating department. Duties will cover preparation of specifications, technical quotations and customer correspondence in the projects section dealing with large-scale contracts. Prospects are good in a new and developing field of engineering. Salary will be assessed according to qualifications and experience and there is an excellent superannuation and life assurance scheme in operation. Applications should be addressed, in confidence, to the Personnel Officer, Philips Electrical Limited, Century House, Shaftesbury Avenue, London, W.C.2, quoting ref. 115. 6707

REFRIGERATION engineers, fully experienced, for the London and Greater London areas. High salary and commission for right persons. Transport provided. Strict confidence. —Telephone J. C. M., MUSeum 0990. 6570

PHILIPS ELECTRICAL Ltd. A vacancy exists in the lighting division of this company for a commercial assistant. Applicants should be between 25/35 years of age with experience of commercial correspondence, enquiries and quotations in the field of lighting fittings and accessories. The appointment is in our London headquarters and carries an attractive salary and other benefits. Applications giving brief details of age, qualifications and experience should be addressed to the Personnel Officer, Century House, Shaftesbury Avenue, London, W.C.2, quoting ref. 118. 6770

REPRESENTATIVE required by old-estd. electrical distributors for Hammersmith, London, area. Applicants residing and with connection in this area will receive preference. Car an advantage but intimate knowledge of trade is essential. Write stating full details of experience, with age, to—Box 6740.

SALES organisation of The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2, has vacancies in industrial heating department for young men with a sound engineering background, preferably to O.N.C. level, and with potential sales and/or administrative ability. Future career prospects excellent. Apply in writing to the Staff Manager (Ref. IH) giving details of age and record. 6691

SALES representative (age 25/30 years) with electrical engineering background required by old-established electrical engineering company in North-West London, to train as sales representative. Superannuation scheme. Write giving full details of age, experience and salary required to—Box 3MD.2783, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2. 6708

SALES representative reqd. by leading E.W.F. wholesalers for London and the Home Counties. The appointment offers unlimited opportunities and excellent prospects to experienced salesman with good connections amongst contractors, factories and stores. Good salary, commission, car expenses, entertaining, etc. Write fully in confidence stating age and experience.—Box 6692.

SANTON Ltd., owing to a staff promotion, invite applications for a position as representative in the London area. A young man with the correct background will be considered. Applications by letter only, which will be considered strictly confidential, should provide full details of training, experience and present salary, together with usual personal particulars, and should be addressed to East Acton Arcade, Old Oak Common Lane, London, W.3. 6693

SENIOR instrument engineer with H.N.C. or equivalent required for expanding instrument section. Knowledge of modern instrument practice essential, with experience of electronics, recorders and controllers of all types, and flame failure devices. The factory is situated in ideal country surroundings, 25 miles S.E. of Manchester and 6 miles N. of Buxton. There is a contributory pension scheme. Apply in writing, giving details of age, qualifications, experience and salary required, to the Personnel Manager, Ferodo Limited, Chapel-en-le-Frith, Via Stockport. 6724

SIEMENS EDISWAN SWAN Ltd., Woolwich works, London, S.E.18. Experienced electrical engineers required to join in the work of a rapidly expanding division on the design, development and engineering of a new range of electronic and allied equipments. Knowledge of one or more of the following essential: electronic and telecommunication switching, audio engineering, remote control, indication projects, process control. Scope for original thinkers to apply new ideas, backed by full resources of large modern factories. Starting salaries from £800-£1,000 for senior men with adequate experience. H.N.C. or equivalent desirable, but all applicants will be assessed in the light of their experience. Men of the right calibre, seeking further experience, responsibility and hard work, should write with full details to the Staff Officer, Ref. 744/82, address as above. Any housing or removal queries can be helpfully discussed. 287

TECHNICAL assistant required with H.N.C. or Degree in Physics or Electrical Engineering, to deal with various aspects of development of power capacitors and the use of a surge-generator of 1½ m. volts. The post also provides a good opportunity for experience in the high-voltage field in connection with the testing of power transformers up to 15,000 kVA. Apply in writing in the first place to — Chief Engineer, Bryce Electric Construction Co. Ltd., Kelvin Works, Hackbridge, Wallington, Surrey. 6669

TECHNICAL cttee. secretary, aged 25-35, required by electrical trade assocn. Tech. experience an advantage but not essential. Pension and insurance scheme. State qualifications, experience and salary required.—Box 6694.

TECHNICAL sales engineer (junior), preferably studying for H.N.C. (Telecoms.), required. An interesting position coupled with excellent prospects is open to a keen and intelligent engineer. Knowledge of relays an asset. Staff canteen. Write giving full details of education, experience, etc., to—Personnel Manager, Telephone Manufacturing Co. Ltd., Martell Road, West Dulwich, London, S.E.21. 6725

TELEPHONE maintenance engineers required for Cardiff area, also vacancies available for Bristol area. Permanent positions with pensions. Write full details, age, experience. — Reliance Telephone Co., 23, Lawrence Hill, Bristol. 6726

TRANSFORMER designer (senior) required. Applicant must have wide experience in design and manufacture of units up to 250 kVA. Promotion to directorship offered after qualifying period with commensurate salary and bonus. Housing accommodation if required. Replies will be treated in strict confidence.—Stewart Transformers Ltd., 75, Kilburn Lane, London, W.10. 6670

TRANSFORMER testing. Chief of test required with experience in testing high-class transformers, L.F. chokes and power transformers up to 250 kVA. Salary commensurate with experience. Apply — Willesden Transformer Co. Ltd., Manor Park Works, Manor Park Road, Harlesden, London, N.W.10. 312

TURBINE Division of the Brush Electrical Engineering Co. Ltd., Loughborough, require experienced tendering and contract engineers. Preference will be given to those having both tendering and contract experience, but consideration will be given to those having one or the other qualification. Technical qualifications to H.N.C. or equivalent are desirable. These vacancies offer first-class opportunities in an expanding organisation, and a good salary will be paid. The factory is situated in a pleasant Midland town, within easy reach of a number of cities. Conditions of service include a generous non-contributory staff assurance scheme. Please apply to the Chief Personnel Officer. 6611

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

A.M.I.E.E., 38, seeks progressive position London/Southern Counties. Experienced design H.V. and L.V. installations, progress, procurement, inspection heavy power equipment. Present salary £1,250.—Box 9051.

B.ENG.(Hons.), A.M.I.E.E., A.M.I.Mech.E. (40), returning U.K. from govt. posting end July, 4½ yrs. consulting engineers, 9 yrs.' manufacturing experience switchgear engineers, seeks executive or resident engineer's post.—Box 9044.

DESIGN and development engineer, B.Sc., A.M.I.E.E. (35), seeks responsible position Central, South or East London.—Box 9046.

ELECTRICAL engineer, just returned from 4 years overseas, experienced contracting, estimating, installations, overhead lines, underground cables, motor repairs, requires supervisory position home or overseas.—Box 9048.

ENGINEER (31) seeks position offering advancement as reward for diligence. Graduate I.E.E., H.N.C., Mechanical, with experience of marine, medium engineering and textile plant installations.—Box 9043.

TO manufacturers: Wholesaler's branch manager, early 40's, energetic and more ambitious than present scope will allow or reward, seeks change to first-class representation.—Box 9027.

WEST Country wholesalers. Buyer (36) resident Bath, 12 years' experience, seeks position with more scope. Conversant all aspects wholesaling.—Box 9050.

WINDING shop. Foreman/manager (40), experienced all types windings, assembling motors, coils, transformers, A.C./D.C. production or repair shop, desires progressive position. —Box 9049.

ARTICLES FOR SALE

LARGE A.C. MOTORS

3-phase, 50 cycles

Maker.	h.p.	Volts.	r.p.m.
B.T.H.	1820	3.3 kV	368
B.T.H.	1800	400/440	368
B.T.H.	1400	6.6 kV	368
L.D.M.	900	3.3 kV	485
L.D.M.	900	400/440	485
L.D.M.	750	6.6 kV	485
MATHER & P.	350	400/440	730
E.C.C.	300	400/440	580
MATHER & P.	300	400/440	750
B.T.H.	275	400/440	485
B.T.H.	250	400/440	480
BRUSH	250	400/440	420
E.C.C.	175	400/440	580

Reconditioned and guaranteed.

THOS. W. WARD LTD.
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CRABTREE I.C. SWITCH AND FUSEGEAR

WE have purchased the remaining stocks of this make and can offer immediate delivery of most types from 10 to 100 amps., D.P., T.P. and S.P. & N.; also

CRABTREE WOOD-CASED DISTRIBUTION BOARDS

and spare fuse bridges for most of the range.

Very Attractive Discounts.

Apply for complete lists of types available:

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ARC WELDERS FOR SALE

NEW 20/300-amp. Oxford Arc Welders, oil-immersed in boiler plate steel tank, for operation on 400/440 v., 50 cycles; coarse and fine regulators provided; dual welding voltage.

Immediate Delivery. Attractive Prices.

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600-kW BELLISS-LAURENCE SCOTT Steam Set, 120 lb. steam pressure, 2-10 lb. back pressure, coupled to 750-kVA Alternator, 400/3/50, 300 r.p.m., with switchboard. Built 1936. Excellent condition.

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PREPAYMENT and credit, 200/250 v. A.C., s/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.

ALBERICE METER COMPANY
Fairfax Works, Fairfax Rd., London, N.8
(Tel. MOUntview 7944, 6373) 191

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs: we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co., Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A NUMBER of secondhand electric motors offered for sale including 15-h.p. E.C.C., 30-h.p. B.T.H. with contactor starter. 2 28-h.p. E.C.C. (one with pony starter) and Brookhirst switchgear starters, 1 27½-h.p. Crompton Parkinson slipring motor with Allen West starter and ½-h.p. A.C. motor. All 3-phase, 400/440. Available for inspection. Offers invited for single motors or offer for the whole to clear. Apply—J. Alsford Ltd., Twickenham Road, Hanworth, Feltham, Middx. 164

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

Articles for Sale (continued)

A.C. and D.C. 1/- Slotmeters. Guaranteed 2 years, 2½-50 amps. From 50/- Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

ALTERNATORS from ½ to 675kVA in stock, single and three-phase, all voltages and frequencies. Guaranteed. Many unused. Send your requirements.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, generators, 1-100 kVA, all voltages. Specialists—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 147

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

ALUMINIUM, brass and copper in sheets, rods, tubes, angles, etc. Sheared blanks a speciality. Approved stockholders. For immediate attention, phone or send your inquiries—R.D.C., 100, Hamstead Rd., London. N.W.1 (EUSton 5176/7). 352

AUTO transformer starters: 400-440/3/50, 3 O/L N.V., oil imm'd, 75-h.p. Allen West; 60-h.p. Allen West; 45-h.p. Allen West, 40-h.p. Allen West; 35-h.p. Ellison; 30-h.p. Allen West; 27-h.p. Allen West; 25-h.p. Ellison; 15-h.p. Erskine Heap, 3 off.; 50-h.p. Ellison.—J. S. Ramsbottom & Co. Ltd., Keighley (Tel. 3774/5/6). 6772

BARGAINS in electric motors are always being obtained from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Stocks include A.C. and D.C. motors, second-hand and new up to 30 h.p. Starters, slide rails and pulleys. Ring. Mon. 3355 for your requirements. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 140/-. See Quarterly.—Tradex, Surbiton. 170

CABLE for sale: .1 sq. in. 4-core P.I.L.C. S.W.A. & S., C.M.A., brand new, 660-volt grade, 2 500-yard drums and 1 214-yard drum, £1 per yard. .04 sq. in. 2-core P.I.L.C.S.W.A. & S., C.M.A., 4s. 6d. per yd.—C. M. Hartshorne & Co. Ltd., 778, New Hey Road, Huddersfield (Tel. Stainland 2103). 9025

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (Ealing 3155/6). 117

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

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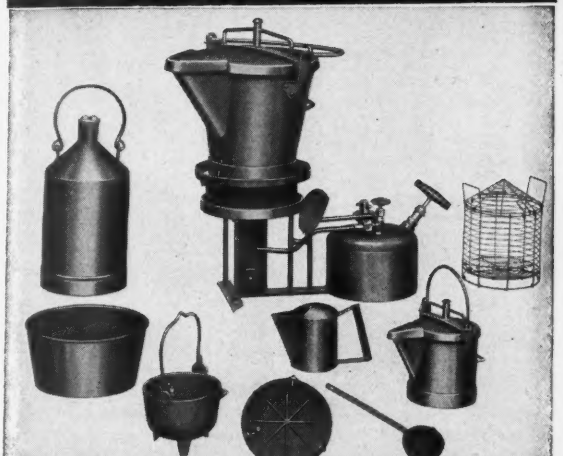

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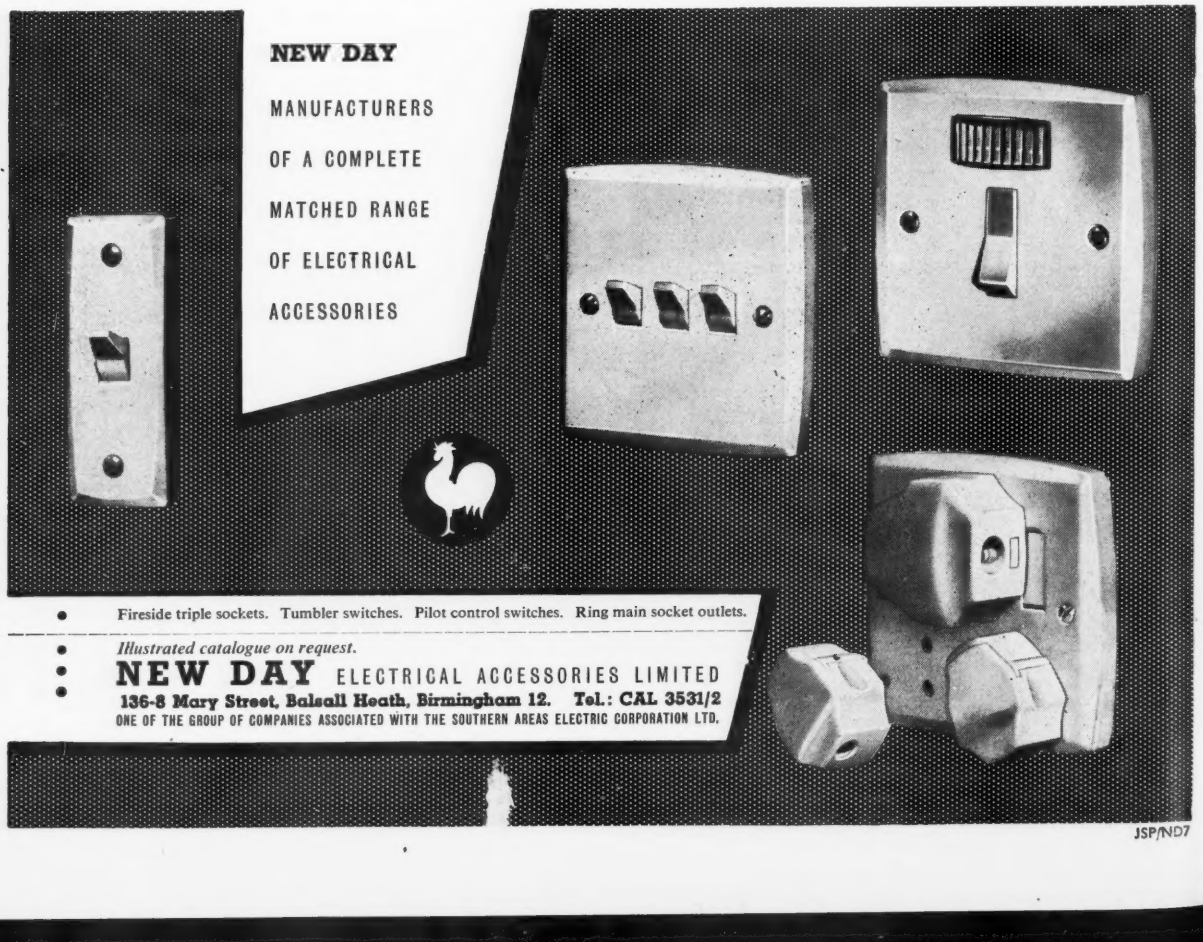
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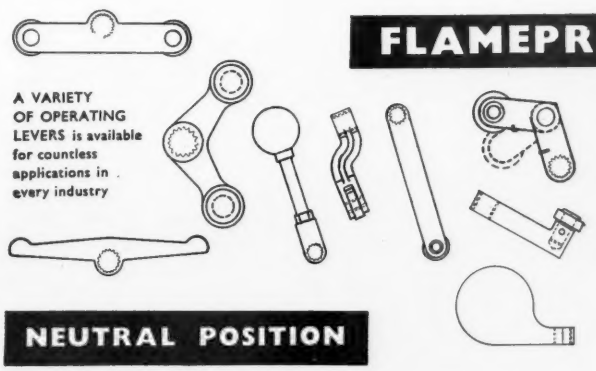

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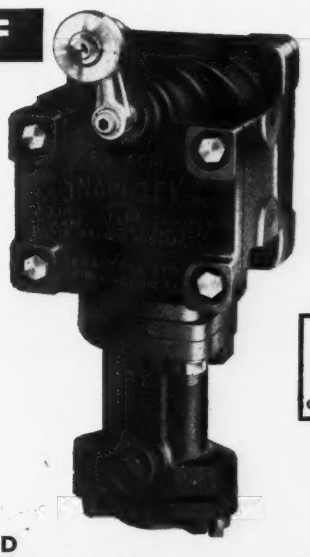

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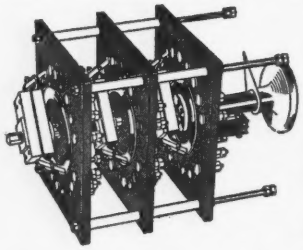

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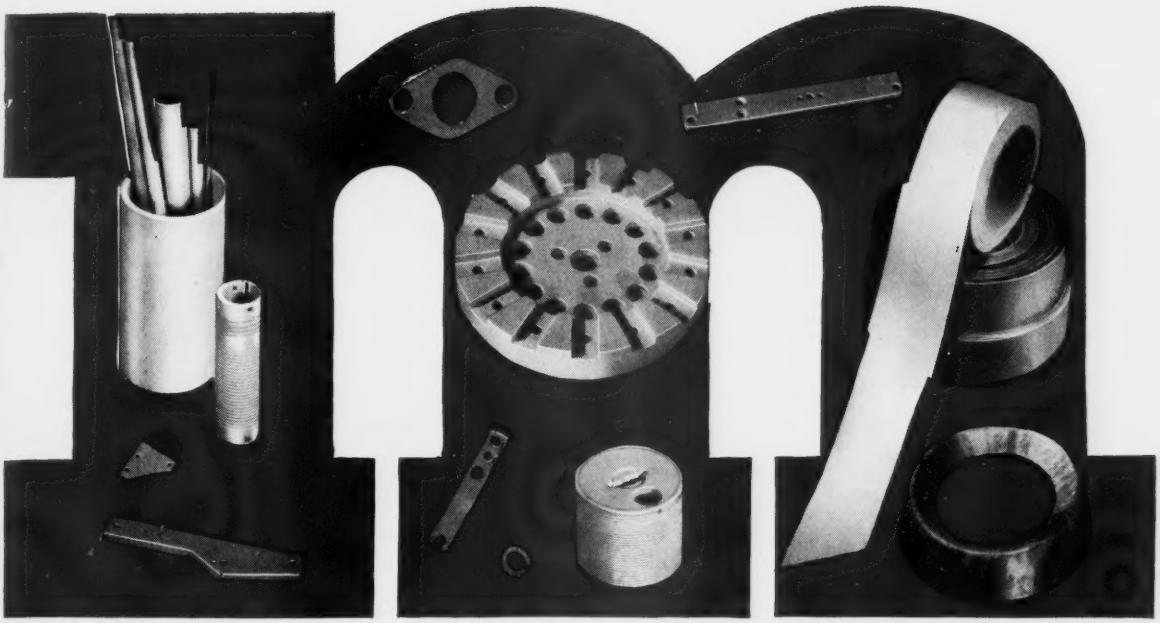

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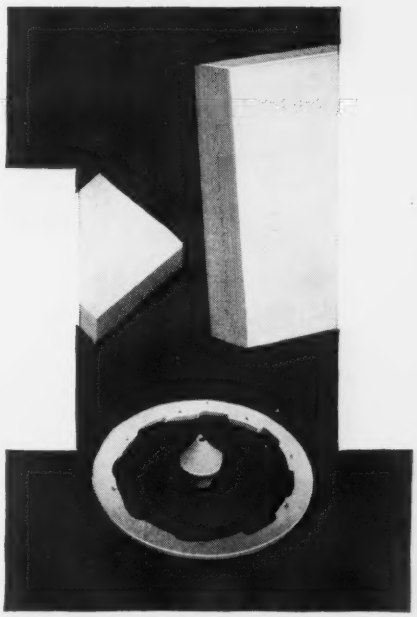

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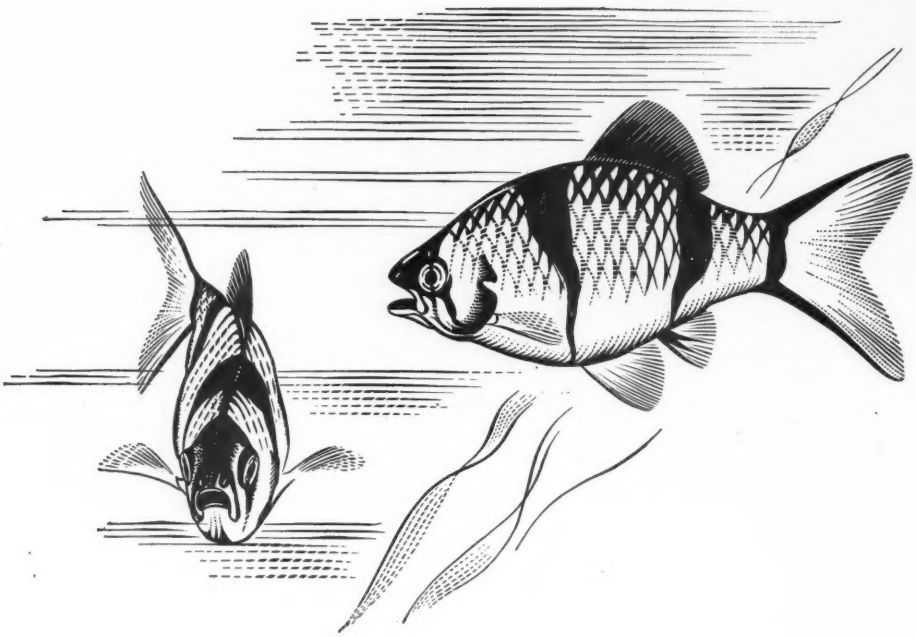

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